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A MODEL FOR PREDICTING THE LOCATIONS OF PREHISTORIC ARCHAEOLOGICAL SITES ON WISCONSIN ELECTRIC HYDRO LANDS ON THE MICHIGAMME AND LOWER PAINT RIVERS IN IRON AND DICKINSON COUNTIES IN UPPER MICHIGAN AND THE BORDER RIVERS BETWEEN WISCONSIN AND MICHIGAN (BRULE & MENOMINEE) AND THE PINE RIVER IN FOREST COUNTY, WISCONSIN.

REPORT OF INVESTIGATIONS NO. 102186

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ABSTRACT

This report describes the development of a model for predicting which of certain WE hydro project lands are likely to contain prehistoric archaeological sites. The lands are adjacent to the Michigamme and Lower Paint Rivers in Iron and Dickinson Counties in upper Michigan, the border rivers between Wisconsin and Michigan (Brule, Menominee) and the Pine River in Forest County, Wisconsin. Twelve hydro projects were initially involved in the study: Way Dam, Hemlock Falls, Lower Paint, Peavy Falls, Michigamme Falls, Brule, Pine, Twin Falls, Kingsford, Big Quinnesec, White Rapids and Chalk Hill (Van Dyke 1997). The number of hydro projects involved in the study was later reduced to ten when the White Rapids and Chalk Hill hydros were removed.

The model was developed over a period of three years with two field seasons of sampling followed by a third field season during which limited surveys were conducted to test the model. At least three prehistoric sites were found in a sample of 123 acres of higher probability (HP)areas while no prehistoric sites were found in at least 300 acres of lower probability (LP) areas.

We believe that this is a workable model for prehistoric site locations. It does not guarantee that prehistoric sites will be found in HP areas, rather, it indicates that there is a greater likelihood of finding a site in HP areas. It also indicates that there is a lower likelihood that prehistoric archaeological sites will be found in LP areas, in general, with the possible exception of the Big Quinnesec hydroelectric project.

We recommend that this model be used to guide management land use planning. Any development that is planned for HP areas should be preceded by an archaeological survey. Planned development in LP areas should be reviewed in light of the model, the scope of the project, and any new archaeological information. If there is no contraindication, LP areas should require no further survey for prehistoric sites.

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1.0 INTRODUCTION

In 1997, Wisconsin Electric Power Company (WE) began consulting with the Michigan and Wisconsin State Historic Preservation Offices (SHPOs) regarding the development of a predictive modeling approach to assist in identifying archaeological properties on certain WE lands in Michigan and Wisconsin. WE has obtained the concurrence of the Michigan and Wisconsin SHPOs in the methodology to be used in developing the predictive model. The predictive model will define areas that will require an archaeological survey if ground disturbance is proposed and areas that will not require archaeological survey. Once the predictive model has been completely developed, WE may choose to implement its procedures. If WE uses the results of the predictive model to determine the need for a survey, the procedures defined by the model will substitute for consultation as outlined in Section 3.C.(2)(a) of the Historic Resources Management Plan. If the results of the model indicate that a survey is needed, the survey and any other necessary resource-management activities, will be conducted as outlined in Section 3.C.(2)(a). If for any reason the developed predictive model is not adopted, WE will continue to consult with the Michigan and Wisconsin SHPOs, as appropriate, regarding survey needs in accordance with the conditions stipulated in Section 3.C.(2)(a) above.

This report describes the development of a model for predicting which of certain WE hydro project lands are likely to contain prehistoric archaeological sites. The lands are adjacent to the Michigamme and Lower Paint Rivers in Iron and Dickinson Counties in upper Michigan, the border rivers between Wisconsin and Michigan (Brule, Menominee) and the Pine River in Forest County, Wisconsin. Twelve hydro projects were initially involved in the study: Way Dam, Hemlock Falls, Lower Paint, Peavy Falls, Michigamme Falls, Brule, Pine, Twin Falls, Kingsford, Big Quinnesec, White Rapids and Chalk Hill (Van Dyke 1997). The number of hydro projects involved in the study was later reduced to ten when the White Rapids and Chalk Hill hydros were removed by WE for reasons explained later (Section 2.0).

The model is based on a sample design that consists of several steps. The first step was a thorough literature search during which were gathered all available facts on previously reported archaeological sites within about six miles of the hydro project boundaries.[1] The literature search provided base line information on a variety of categories including site location, density, type and age, but not all categories for each site. The resulting list was short; few prehistoric sites were known in or near the hydro project lands and little was known about any of the sites. Archaeological surveys had been few and far between. Thus, the next step of the sample design was to survey a sample of WE land holdings and discover more archaeological sites. The total number of previously known and newly discovered prehistoric sites would then comprise a database from which a sample of sites could be selected to provide environmental variables to describe a site profile or "typical" prehistoric site setting. In other words, the objective was to discover which environmental variables were common to most known prehistoric archaeological sites in that area. The opinion of other archaeologists who had conducted surveys in the upper peninsula in the 1970's was that any sample design should include a minimum 20 percent fraction (Martin and Martin 1979). Further, since area archaeology was largely unknown, we decided to follow conventional wisdom in the design which was, "for surveying unknown areas, the simplest sampling designs may well be the most practical" (Plog 1976:158).

2.0 SAMPLE DESIGN

A multi-stage sample design was proposed consisting of two consecutive years of sampling followed by a third year of testing a preliminary model to be formulated from the results of the first two years of sampling (Van Dyke 1997). The sample design was a simple random sample with units consisting of transects, long lines that cross-cut the land holdings at perpendiculars to the course of the river and reached out to the property boundaries. A twenty percent total sample for each hydro project was to be attained in two years. Fieldwork was to occur over a two year period because it was judged that a ten percent sample would take 10-12 weeks to complete. Thus, a twenty percent sample could not be easily accomplished in one field season. It addition, after one season of

[1] Six miles was an arbitrary choice. WI SHPO has generally asked for sites within 2-3 miles of reservoirs.

sampling in remote settings with difficult access, we might want to analyze the results and make adjustments in the on-the-ground technique, perhaps switching to quadrat sample units.

The process began with two consecutive field seasons of sampling ten percent of the land area of each hydro. To select a ten percent sample, the total number of acres of land within each hydro project boundary was obtained from WE, and property boundaries were drawn onto the 13 USGS 7.5' quadrangle maps encompassing the hydro project lands.[2] Sheets A-1 through A-19 show project boundaries in heavy black line. Each project was divided into 100 meter wide survey transects based on the Universal Transverse Mercator grid (UTM) that were aligned, in general, perpendicular to the general trend of the river.[3] Each transect was numbered from 1 to *n*, beginning at the north end of each hydro project boundary. If a transect was interrupted by a body of water larger than a small stream (e.g. a small bay), a new number was assigned to the transect on the other side of the water (see Sheets A1-A19). Transects were aligned in cardinal directions, either north-south or east-west, in order to facilitate navigation by the survey crew in the heavily-wooded environment. The acreage of each survey transect was calculated and recorded in a table along with the length and width of the transect. A random number table was used to select transects to be surveyed. The acreage of the first transect selected was recorded, then another was selected and the acreage of that transect was added to the previous selection until the total equaled approximately ten percent of the total acreage of the land holdings for that hydro project. The same procedure was repeated for each of the twelve hydro projects. It was repeated the following year so that a twenty percent sample was obtained for each hydro project.

The random sample was an unbiased way of selecting places on the ground to search for sites. We hoped that the transects would cross-cut many micro environments and give an accurate representation of those environments even though micro-environmental information was not collected, but we sought to cut across the full range of environments. Transect sampling was continued through the second year for that reason. Quadrats, depending on the size, might have

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2 Sheets A-1 through A-19 are portions of 13 USGS quadrangles. There is some overlap of USGS maps on the 19 sheets.

3 Not all project boundaries were neatly coincident with the 100 meter wide transect. An occasional transect might be narrower.

limited the number of micro-environments that could be encountered in the sample. Sampling in transects has been shown to be more efficient than sampling in quadrats for this purpose (Plog 1976).

After two years of sample surveys, 4,252 acres (of 22,132 total acres) had been surveyed and 18 new archaeological sites were found; 15 of them (83.3%) were on the two southern hydro projects, White Rapids and Chalk Hill (Van Dyke 1999a, 2000). They were found in a sample of 554 acres (13% of the total 1998 and 1999 sample surveys which constituted the entire 20 percent sample of White Rapids and Chalk Hill). Furthermore, 44 of 64 previously known archaeological sites (68.8%), were also reported on the White Rapids and Chalk Hill hydro projects on the Menominee River. Put another way, 72 percent of all presently known prehistoric archaeological sites on WE hydro project lands are clustered in the southern 12.6 percent of the hydro lands (the White Rapids and Chalk Hill hydro projects), while 28 percent of all known prehistoric sites are on the other 87.4 percent of the hydro lands. WE management decided to withdraw White Rapids and Chalk Hill from the model project for two reasons: 1) archaeological site density on White Rapids and Chalk Hill hydros is so high that any future construction would almost certainly require an archaeological survey regardless of the outcome of the model, and, 2) there are no long-term management plans for construction on those hydro lands. Thus, ten hydro projects remained in the modeling project.

3.0 SITE AND MAP DATA

We sought to describe a "typical" prehistoric site location based on all known site settings within about six miles of the hydro project after two years of sampling. A data base of 110 archaeological sites was compiled with 82 prehistoric and 28 historic period sites.[4] Appendix B-1 is a list of the prehistoric sites by site number and hydro project name. After removing the sites on White Rapids and Chalk Hill hydro projects, and seven other sites for which there is insufficient information, 31 prehistoric sites remained. One other site, 20IO220 (Van Dyke 1999b) was added to the sample to bring the number to 32 prehistoric sites with which to characterize a typical site

[4] This a model for prehistoric sites only. Thus, there is no further mention of historic sites.

setting.[5] Appendix B-2 lists the 32 prehistoric archaeological sites and all relevant information about each site. The 32 sites are reported from six hydro projects: Way Dam, Twin Falls, Pine, Michigamme Falls, Lower Paint and Big Quinnesec. There are no known prehistoric sites on Peavy Falls, Kingsford, or Hemlock. The tenth hydro, Brule, has three reported sites. They were evaluated for NRHP eligibility and found to be not significant (Brazeau 1989, 1991). After further review of all information, plus site visits, these were determined not to be archaeological sites at all but natural quartz distributions (Van Dyke 1996).

Little is known about any of the 32 sites with the exception of 20IO220, an NRHP eligible site, so there is little cultural information to consider. Most of the sites lack a cultural identity (e.g. Late Woodland or Archaic). To summarize, the 32 sites represent 33 to 38 components (it is unclear from site records if, e.g., *unknown prehistoric/Archaic* means an unknown prehistoric component **and** an Archaic component [i.e., 2 components], or if it means an unknown prehistoric component that **may be** Archaic [i.e. 1 component]): 17 are listed as *unknown prehistoric*, 4 are listed as *Woodland*, 1 is listed as *Late Woodland/Archaic?*, 1 is *Middle & Late Woodland*, 4 are listed as multi component *unknown prehistoric/* plus an additional component (e.g. */Archaic? /historic, /Archaic/Woodland, /Paleo Indian*) and 4 have no listed cultural affiliation.

After reviewing all site data, it was determined that the characteristics of *slope*, *aspect*, *distance to nearest water*, and *distance to the next nearest water source* would be used to develop a characteristic site profile. The first three were picked because these data could be obtained from USGS maps or could be calculated by the Digital Elevation Model (DEM, see below). We felt that distance to a second water source was also an important factor based on our research on the White Rapids and Chalk Hill hydro projects, but those hydro projects were removed from the sample project. Because there are so few known sites on the hydro projects north of White Rapids and Chalk Hill, distance to second water did not appear to be an important variable until we plotted the known site locations on a 1930 U.S. Army Corps of Engineers (COE) pre-dam map of the

5 This model is based on environmental variables, not cultural variables, so it is an environmental model, not a cultural model.

Michigamme River that was found in the WE Iron Mountain archives. Following that, distance to a second water source again appeared to be a meaningful variable and was retained.

The pre-dam river channels for Way Dam were digitized using section corners as control points. A map for Way Dam was reproduced from the COE map and the 1913 Sagola 15' quadrangle which was obtained from the USGS in Colorado. The Peavy Falls pre-dam river course was digitized from the 1913 Sagola 15' quad. This was done for these two hydros because the dams created large reservoir lakes on those projects while such lakes were not created in the other hydro project areas. Thus, the pre-dam channels in the other projects are very similar to their configurations today with the exception of the southern end of Twin Falls.

4.0 DEFINITIONS, DATA SOURCES, PROCESSING

4.1 General Definitions [6]

Geographic Information System (GIS)

A GIS is an organized collection of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information. The GIS software used for this project is ArcInfo developed by Environmental Systems Research Institute, Inc., (ESRI) Redlands, California.

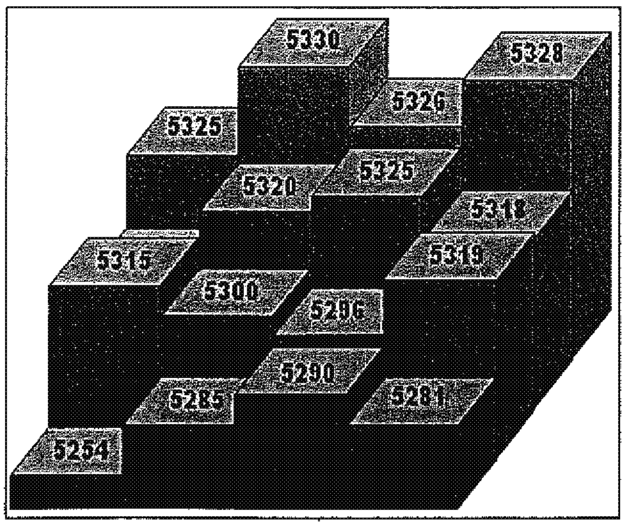


Figure 1: Representation of DEM data. Each grid cell has an elevation associated with it

Digital Elevation Model (DEM)

The term digital elevation model or DEM is used to refer to a digital representation of a topographic surface. For purposes of this study it refers specifically to a raster or regular grid of spot heights as shown in Figure 1.

[6] All GIS work was done by Mead & Hunt Inc., of Madison, Wisconsin.

The DEMs used in this project were obtained from the United States Geological Survey (USGS) and have grid resolution of 30 meters. In other words the *x* and *y* dimension of each grid cell is 30 meters.

Digital Raster Graphics (DRG)

DRG are scanned versions of the USGS topographic quadrangles. These files are scanned at 250 dpi and projected to a common map coordinate system.

4.2 Data Sources

USGS 30-meter Digital Elevation Model (DEM)

The individual DEMs for the appropriate quad sheets were obtained from USGS. These were appended into a seamless DEM for the whole study area (Michigamme Reservoir to below White Rapids Dam).

USGS Digital Raster Graphics (DRG)

Scanned versions of the appropriate USGS quadrangle maps for the study area were used as a backdrop image for the maps.

Previously Known Archeological Sites Locations and Parameters

The locations of all previously known prehistoric sites and were obtained by conducting literature searches (and repeat visits) to various locations: Wisconsin Historical Society, Madison, Wisconsin; Michigan Historical Center, Lansing, Michigan; Crystal Falls Community Library and Harbour House Historical Site, Crystal Falls, Michigan; Florence Library, Florence, Wisconsin; Iron County Museum, Caspian, Michigan; Menominee Range Historical Foundation Museum, Dickinson County Library, and Last Chance Saloon, Iron Mountain, Michigan; Pentoga Park "Old Chippewa Cemetery", near Chicagon Lake in Michigan.

Current River Courses/Reservoirs

Current river courses were provided by Steigerwaldt Land Services of Tomahawk, Wisconsin, and are part of the WE GIS database. They were created by digitizing USGS 7.5' quadrangle maps, and using aerial photographs to update the rivers and tributaries to match current conditions.

Single-line Tributaries

Single-line tributaries data were provided by Steigerwaldt Land Services and are part of the WE GIS database. They were created by digitizing USGS 7.5' quadrangle maps, and using aerial photographs to update the rivers and tributaries to match current conditions.

Corps of Engineers Map

A hydrology river course layer was created in the GIS by replacing the Michigamme and Peavy Falls reservoirs with their pre-dam river courses. A 1930 pre-dam topographic map (1:24,000 scale) showing the projected extent of the Way Dam hydro project reservoir (Michigamme Reservoir) was found in the WE archives in Iron Mountain. This map was digitized and used to show the pre-dam river course through the present reservoir.

Historic USGS Quadrangle

The 1913 USGS Sagola 15' quadrangle (pre-dam) was obtained from the USGS in Colorado for use in digitizing the Peavy Falls pre-dam river course.

4.3 Processing

To develop information on a typical site location, the previously known archeological site locations were examined and the following variables were selected:

- Slope
- Aspect
- Distance to Nearest Water (1st **H2O** in Appendix B-5)
- Distance to Next Nearest Water (2nd **H2O** in Appendix B-6).

The variables are discussed in more detail in Section 3.4.

Slope within the DEM refers to the maximum rate of change in elevation from each cell to its neighbors and represents the degree of slope for each cell. In more common terms, slope refers to the angle of the site surface with respect to level (level = 0°) and is measured in degrees. A slope grid was created from the DEM using ArcInfo.

Aspect within the DEM refers to the steepest downslope direction from each cell to its neighbors. In common terms, aspect refers to the direction of the slope; 0 is true north, 90° is east, and so forth. An aspect grid was created from the DEM using ArcInfo.

Model Development - Determining Known Archeological Site Characteristics. Most previously known sites were quite small so that site information could be gathered easily. However, in cases where the slope grid provided a range of slope values for a site, all site information was reviewed and a single representative slope was selected for the site, usually based on the most prevalent slope relative to site area.

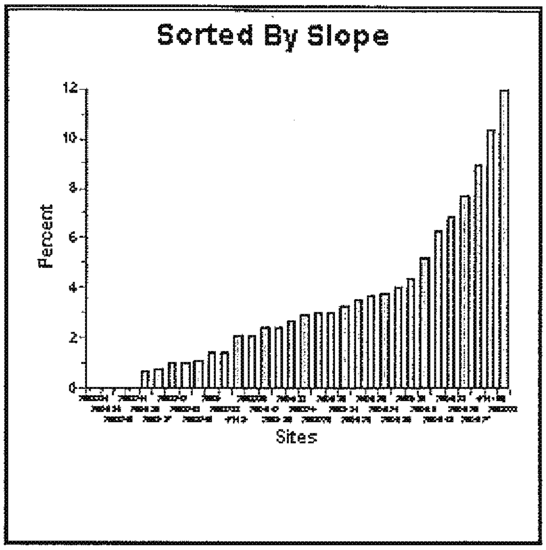
Similarly, in cases where the aspect grid provided a range of aspect values for a site, all site information was reviewed and a single aspect was selected, usually based on the most prevalent relative to site area.

Distance to Nearest Water is given in feet from the center of the archaeological site as it is entered in the GIS. In the case of Way Dam and Peavy Falls, distance to nearest water is based on the pre-dam maps discussed earlier. For all other projects, the nearest water source is the main stem of the current river determined from USGS 7.5' quadrangle maps.

Distance to Next Nearest Water is the distance to the closest first order tributary of the main river. In the case of Way Dam and Peavy Falls, distance to next nearest water is based on the pre-dam maps.

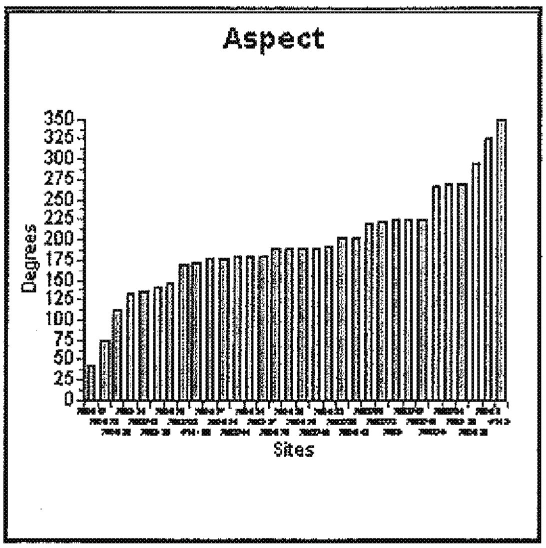
4.4 Selection Criteria

Slopes for the 32 sites ranged from 0 to 12 degrees. Slope was sorted from low to high in Correl Quattro Pro 9.0. Appendix B-3 gives the slope for each site. Slopes were depicted on a histogram (insert) and the mean slope was calculated ($\bar{x}$=3.4°). The mean plus one half the standard deviation of the mean (s = 3.0) was used as the cutoff (4.9°) for selecting slope.



Twenty five of 32 sites (78.1%) have a slope of 4.4 degrees or less, while seven sites (21.9%) have slopes from 5.2 to 12 degrees. Information for the latter seven sites was reviewed again to determine why the slopes for these sites might be, in some cases, much greater. In each case, the site was on the edge of a bank high above a river. When the DEM calculates slope, it is usually the steepest slope (i.e. highest number) that dominates the calculation so that while a location may be perfectly flat (slope = 0°), if it is adjacent to a 30 foot high bank, the calculated slope will be greater than level. In cases where we had made site visits (6 of 7 sites), we knew that this was the case. Site 20DK28 was the only site not visited by us.

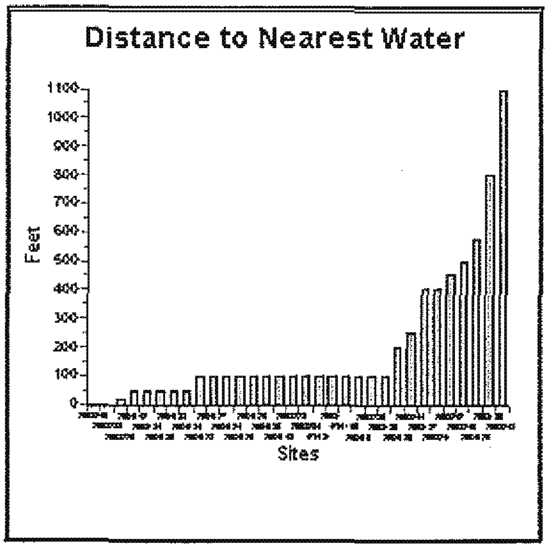
Aspect was examined for each of the 32 sites. Sorted from low to high in Correl Quattro Pro 9.0, they were depicted on a histogram (inset) and the mean aspect was calculated ($\bar{x}$=196.0). Appendix B-4 gives the aspect for each site. Twenty four of 32 sites (75.0%) have aspects between 112 and 225 degrees, two sites have aspects of less than 112 degrees and six sites have aspects greater than 225 degrees. Information for the latter eight sites was reviewed again to verify the aspects.



SITE LOCATION MODEL FOR PREHISTORIC ARCHAEOLOGICAL SITES

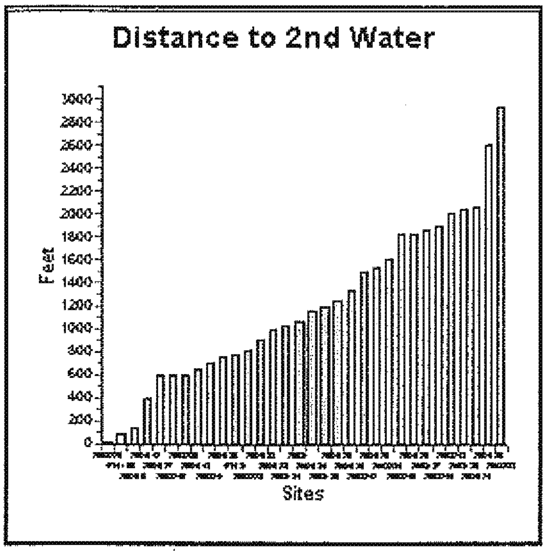
Sites 20IO241, 20IO185, 20DK42 and 20DK36 are inundated by Michigamme Reservoir. The artifacts were found by an artifact collector while they were exposed during a low water stage in the late Fall of 1994 (20IO185, 20DK36) and 1998 (20IO241, 20DK42). Since they were found on the flat bottom of a reservoir, aspect cannot be determined by the DEM; therefore, we assigned an aspect based on map inspection and an assumption as to the location of the predam river channel. The aspects calculated for sites 20DK6 and 20DK28 may be affected by micro topographic variation, similar to what can happen to the slope calculation near a steep bank. Site 47FL31 is on the north bank of the river across from the confluence of the Michigamme and the Brule River (the two become the Menominee River at this point). This is a unique setting and the site has a north aspect. Similarly, 20IO234 is on the east bank of the Paint River and has an aspect of about 270 degrees. Thus, only the latter two (6.2% of the total) have aspects that are known to differ from the range used to select the variable range for the model.

Distance to Nearest Water ranged from 1 to 1,100 feet from the center of the archaeological site (inset). In most cases the nearest water was the main stem of the river flowing through the hydro project, but in some cases, the Way Dam project for example, it could be the distance to a predam stream (Appendix B-5). The mean ($\bar{x}$=201.5 feet) and standard deviation (s=244.9 feet) were calculated and the mean plus one standard deviation (~ 446 feet, rounded up to 575 feet) was used as a buffer. That distance included 30 of 32 sites (93.8%).



Two sites are outside that distance, both reported by a local artifact collector. Site 20IO243 is 1,100 feet from a predam lake (now inundated) and about 2,000 feet from the main stem of the Michigamme River. Site 20IO186 is 800 feet from a creek (now inundated) that was tributary to the Michigamme River, about 800 feet from a marsh (now inundated), and about 2000 feet from the Michigamme River. Both site locations are unique in that the Distances to Nearest and Next Nearest

Water are farther by a great deal more than any of the other sites, but they represent only 6.2 percent of the sites used to establish Distance to Nearest Water.



Distance to Next Nearest Water (or Distance to 2nd Water) ranged from 20 to 2,930 feet from the center of the archaeological site (inset and Appendix B-6). Second water sources were first order tributaries of the main stem of the river. The mean ($\bar{x}$=1,211.3 feet) and standard deviation (s=704.9 feet) were calculated. The sum of the mean plus one standard deviation, ~1,916 feet rounded up to 2,000 was used as a buffer around the second water sources. Thirty of 32 sites (93.4%) were within about 2,000 feet of a second water source.

Two sites were outside that distance. Site 20DK30 (Witkowski et al. 1994) consisted of one quartz, one chert and two quartzite flakes found on the surface of a stream-side trail. The private landowner denied permission for further work so nothing more is known about the site. Site 20IO238 is a single piece of quartzite found by an artifact collector during a low water level in October 1998.

Elevation above sea level (asl) for each site was calculated by the DEM. The histogram for elevation (Appendix B-7) reflects the natural change in elevation above sea level between the higher northern hydro projects and the lower southern projects. Elevation was not used as a variable for site selection.

5.0 FIELD MAP PRODUCTION

To run the model and obtain a set of maps for inspection, the following criteria had to be met for all locations: Slope ≤ 5 **AND**, Aspect ≥124 and Aspect ≤ 225, **AND** distance to the main stem of the river and reservoirs ≤575 feet, **AND** distance to nearest tributary river ≤ 2000 feet. Arc Info was used to generate a coverage layer depicting areas that meet all four criteria of slope, aspect and distance to nearest and next nearest water. These maps (Sheets A-1 through A-19), were used to guide archeological survey to test the preliminary model. They combine the following data layers: DRGs (to show topography), all possible 100 meter wide survey transects (with transect numbers), archaeological survey sample transects from 1998 and 1999 and all previous timber sale surveys (except June, 2002), all known archeological sites within WE holdings, the pre-dam river courses (at Way Dam and Peavy Falls), and areas selected as higher probability for the preliminary model (the red areas on Sheets A-1 through A-19). *Higher probability* areas (HP) are here defined as areas that satisfy all four criteria for an archaeological site location: Slope ≤ 5 **AND**, Aspect ≥124 and Aspect ≤ 225, **AND** distance to the main stem of the river and reservoirs ≤575 feet, **AND** distance to nearest tributary river ≤ 2000 feet. *Lower probability* areas (LP) are here defined as those areas that do not satisfy the four criteria named above.

As part of the research design, we were to test the model in a third season of sampling to verify that sites are more likely to be in the HP areas and less likely to be found in the lower probability areas (LP). We initially proposed to survey a 2½ percent sample of HP and a 2½ percent sample of LP areas to test the model. The GIS-generated maps show HP as areas of red comprised of either individual or contiguous 30-m squares. On a 1:24,000 map, they are very small (one 30-m square equals .2222 acre). For logistical reasons alone (size and difficulty of access or discovery), we could not sample 30-m squares, nor would we want to because they are creations of the GIS based on averaged measurements for a particular place. To arrive at a more manageable size, we looked at blocks or strings of HP area that contained nine or more contiguous 30-m squares (~2 acres). Manual inspection of the GIS-generated maps revealed that a total of 137 transects on ten hydro projects contain HP areas of greater than nine contiguous 30-m squares. These total only 1,094.5 acres (Table 1). A 2½ percent sample of 1094.5 acres is only 27.4 acres, not a meaningful sample, especially when distributed across ten hydro projects. Similarly, a 2½ percent sample of the 137 transects that contain more than nine contiguous 30-m squares is only 3.4 transects.

To summarize, there are 22,132 total acres of land holdings on the ten hydro projects. Based on the first run of the model, there are 1,094 acres of HP area and 21,037 acres of LP area. HP areas totaling 239 acres have been surveyed either through transect sampling (68.3 acres) or through timber sale survey (170.6 acres). This is a 21.8 percent sample of all HP areas. LP areas totaling 4,208 acres have been surveyed either through transect sampling (3,099 acres) or through timber sale survey (1,108.4 acres) (Table 2). This is a 20 percent sample of all LP areas. To test the model through random sampling, at a 2 ½ percent sample size would not provide enough coverage to constitute an adequate test.

Table 1: HP & LP Survey Statistics by Hydro Project as of June, 2002

Hydro Project	tot. hydro acres	tot HP acres avail.	tot. HP surveyed	tot. LP acres avail.	tot. LP surveyed
Big Quinnesec	379.0	23.0	8.0	355.9	59.0
Brule	1,861.2	75.4	58.1	1,785.8	695.2
Hemlock	796.4	75.2	35.2	721.2	309.6
Kingsford	1,615.8	124.0	31.5	1,491.8	359.0
Lower Paint	2,926.7	289.2	104.5	2,637.5	436.1
Michigamme Falls	1,112.1	111.0	48.7	1,001.0	232.3
Peavey Falls	3,580.5	88.2	15.4	3,492.2	707.1
Pine	618.5	17.8	9.1	600.7	134.9
Twin Falls	1,264.6	76.5	3.6	1,188.1	160.0
Way Dam	7,977.1	214.1	46.8	7,762.9	1,332.1
	22,131.9	1,094.5	360.9	21,037.1	4,425.3
% tot. hydro lands		*4.9*	*1.6*	*95.1*	*20.0*
% all HP surveyed			**33.0**		
% all LP surveyed					**21.0**

Map inspection (and the results of our surveys) showed several areas where archaeological sites are more likely to be found (i.e. within 575' of nearest water, 2,000' of next nearest water), and many of these areas have not been tested at all. Locations such as stream confluences, lake inlet/outlet points and marsh-swamp inlet/outlets would not necessarily fall into another random sample. Therefore, we thought it appropriate at this point to conduct purposive sampling, targeting those areas.

In late October/early November, 2001, another group of locations was purposely selected to test the HP areas. Due to the onset of inclement early winter weather, only 123 acres on six hydros were tested. They were distributed as follows: Big Quinnesec - 5 acres, Hemlock Falls - 22 acres, Lower Paint - 56 acres, Michigamme Falls - 25 acres, Peavy Falls - 2 acres, Way Dam - 12 acres. No LP acres were tested at this time.

Three new prehistoric archaeological sites were found in the HP areas. With the completion of the additional 2001 testing of 123 acres of HP area, 361 acres (33%) of the total HP area has now been surveyed (see Table 1). In 2000, a timber sale survey found a prehistoric site within 60 meters

15

Wisconsin Electric Archaeological Predictive Model : Table 2

Summary of High and Low Probability Areas

Transect Areas Surveyed in 1998-1999-2001 and Timber Surveys

Project	Total HP Acres	Total LP Acres	HP Area Surveyed by Transect Survey 1998/1999	HP Area Surveyed by Transect Survey 2001	HP Area Surveyed by Timber Surveys*	LP Area Surveyed by Transect Survey 1998/1999	LP Area Surveyed by Timber Surveys*
Biq Quinnesec	23	356	3	5	0	59	0
Brule	75	1786	16	0	43	236	459
Hemlock	75	721	10	22	3	141	135
Kingsford	124	1492	32	0	0	272	87
Lower Paint	289	2638	30	56	19	210	226
Michigamme Falls	111	1001	20	25	3	178	46
Peavy Falls	88	3492	13	2	1	560	147
Pine	18	601	9	0	0	95	0
Twin Falls	77	1188	4	0	0	116	0
Way Dam	214	7763	35	12	0	1232	0
Column Totals	**1095**	**21037**	**171**	**123**	**68**	**3100**	**1100**

* Excludes transect areas surveyed in 1998/1999/2001 during predictive model survey

of an HP area and no sites in an LP area of 17 acres (Engseth and Van Dyke 2000).

In June, 2002, another 184 acres of LP area were surveyed for timber sales that will occur during 2002. No prehistoric (or historic) archaeological sites were found. Table 1 shows the total survey statistics by HP and LP areas as of June, 2002. Thirty three percent of all HP areas have been surveyed and contain 21 prehistoric sites; 21 percent of all LP areas have been surveyed and hold zero (0) prehistoric sites. Only 19 of the 32 prehistoric sites used to generate the model are actually in HP areas, but another two are within 30 and 60 meters of HP areas. Curiously, seven of the 11 sites (34.4%) not in HP areas are on Big Quinnesec.[7] The single site found on Big Quinnesec during the 1999 sample survey (20DK43) **is** in an HP area. The other six sites were reported in an archaeological survey of the reservoir shoreline in 1994 (Witkowski et al. 1994).

The Big Quinnesec hydro project entirely environmental setting is quite different from sites farther north that are not on the Menominee River. It is more similar to the environmental setting of White Rapids and Chalk Hill where site densities area higher. The fact that the model does not account for site locations at Big Quinnesec does not suggest a weakness in the model, rather, it indicates that it is particular to a distinctly different environmental zone. Therefore, we believe that the Big Quinnesec hydro project should be omitted from the predictive model. Any future construction on the Big Quinnesec hydro should be subject to the same treatment as projects on the White Rapids and Chalk Hill hydro projects.

We believe that this is a workable model for prehistoric site locations on the remaining hydros. It does not guarantee that prehistoric sites will be found in HP areas, rather, it indicates that there is a greater likelihood of finding a site in HP areas. It also indicates that there is a much lower likelihood that prehistoric archaeological sites will be found in LP areas.

We recommend that this model, essentially the set of maps (Sheets A-1 through A-19), be used to guide management land use planning. Any development that is planned for HP areas should be preceded by an archaeological survey. Planned development in LP areas should require no further archaeological survey for prehistoric sites.

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7 The four other sites outside HP areas are: 20IO185 and 20DK36 (on Way Dam, reported by a local collector), and 20IO234 on Lower Paint (Van Dyke 2000) and 47FL165 on Pine (Van Dyke 1999).

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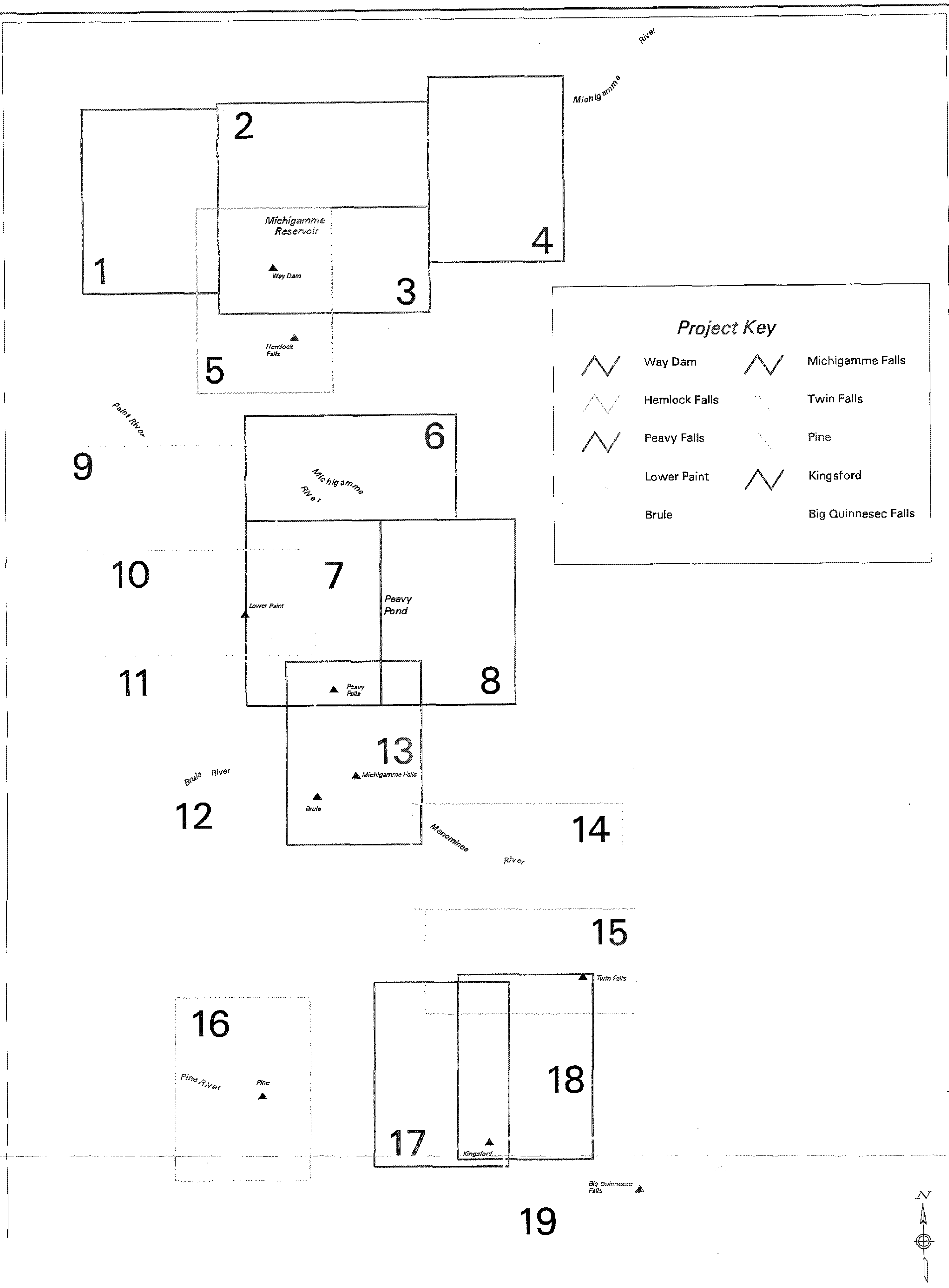


2002 WE ENERGIES ARCHAEOLOGICAL SURVEY

0 1 2 4 miles

Map Note

All map sheets are shown at a scale of 1:24,000.

Classification for Map Sheets

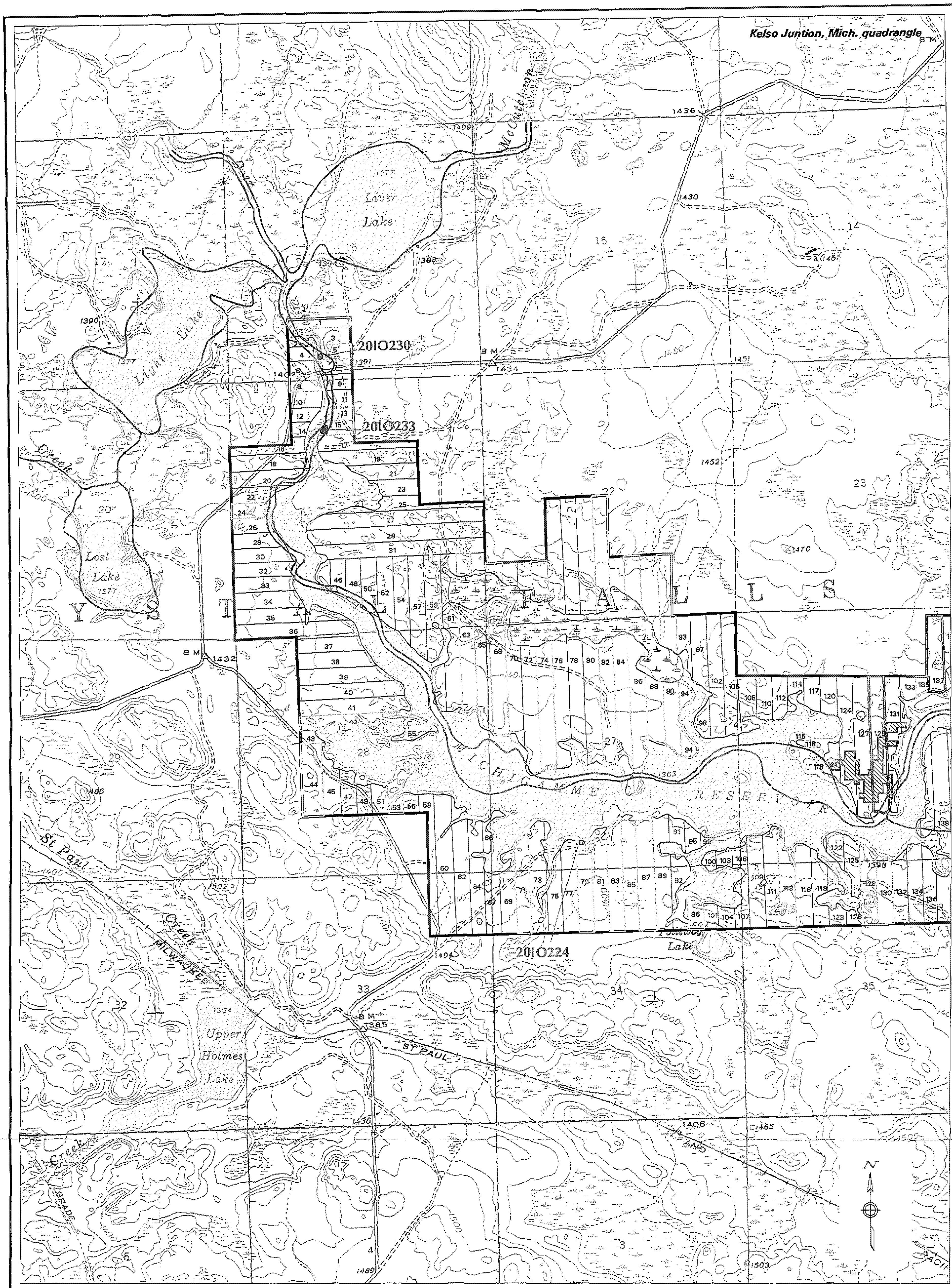
Project Location
Lakes and Rivers
Higher Probability Area
Quadrangle Boundary
Streams
Archaeological Site Location
Historic
Ore Exploration Pit
Prehistoric

Job Number: W24 - 96J
05/09/02
Composed by: bjh

KEY SHEET

MEAD & HUNT ENGINEERS ARCHITECTS SCIENTISTS PLANNERS

AVD Archaeological Services, Inc.



WE ENERGIES ARCHAEOLOGICAL SURVEY MAP

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SCALE 1" = 2000 feet

WAY DAM and MICHIGAMME RESERVOIR

Map Classification

Project Location
Lakes and Rivers
Higher Probability Area
Quadrangle Boundary
Streams
Original River Course

Archaeological Site Location

Historic
Ore Exploration Pit
Prehistoric

Survey Type

Surveyed in 1998 or 1999
Surveyed in 2001
Timber sale

Job Number: W24 - 96J
Date: 05/23/02
Macro: ./W24/96J/archeo/maps02/makemaps.aml

SHEET A-1

MEAD & HUNT ENGINEERS ARCHITECTS SCIENTISTS PLANNERS

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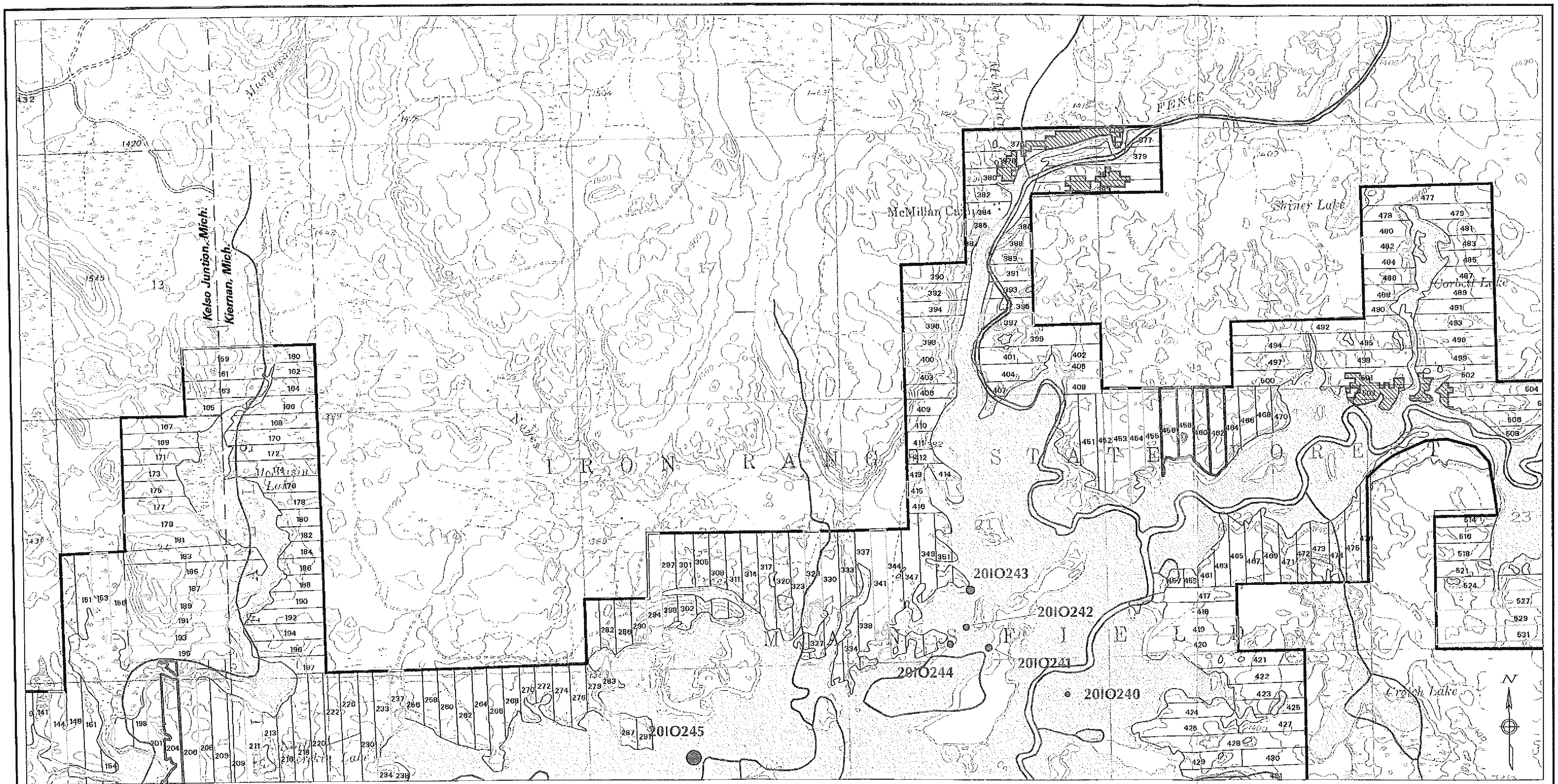

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SCALE 1" = 2000 feet

WAY DAM and MICHIGAMME RESERVOIR

Archaeological Site Location

Historic

Ore Exploration Pit

Prehistoric

Survey Type

Surveyed in 1998 or 1999

Surveyed in 2001

Timber sale

Map Classification

Project Location

Quadrangle Boundary

Lakes and Rivers

Streams

Higher Probability Area

Original River Course

MEAD & HUNT ENGINEERS ARCHITECTS SCIENTISTS PLANNERS

AVD Archaeological Services, Inc.

SHEET A-2

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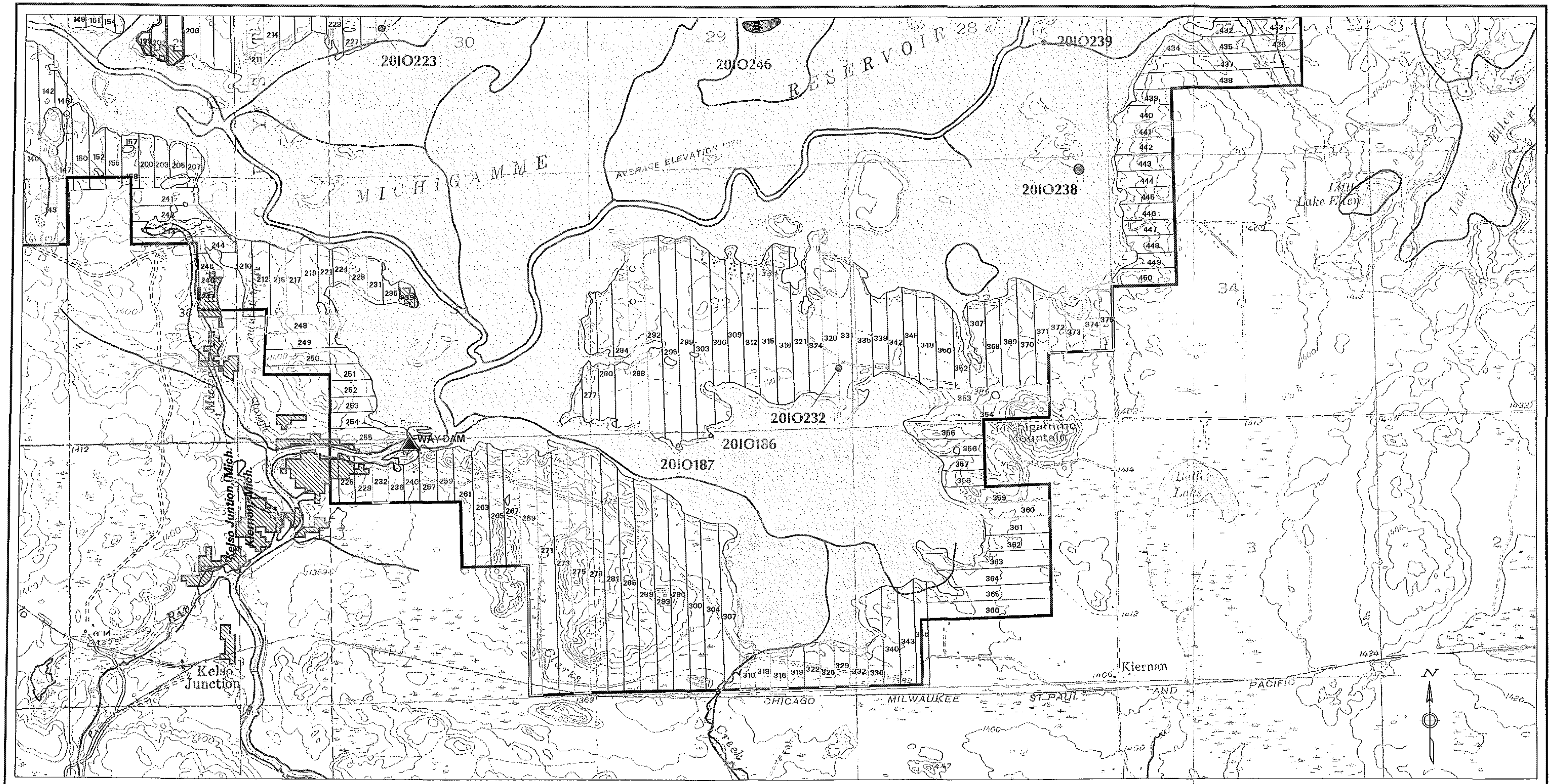

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WAY DAM and MICHIGAMME RESERVOIR

Archaeological Site Location

Historic

Ore Exploration Pit

Prehistoric

Survey Type

Surveyed in 1998 or 1999

Surveyed in 2001

Timber sale

Map Classification

Project Location

Quadrangle Boundary

Lakes and Rivers

Streams

Higher Probability Area

Original River Course

MEAD & HUNT ENGINEERS ARCHITECTS SCIENTISTS PLANNERS

AVD Archaeological Services, Inc.

SHEET A-3

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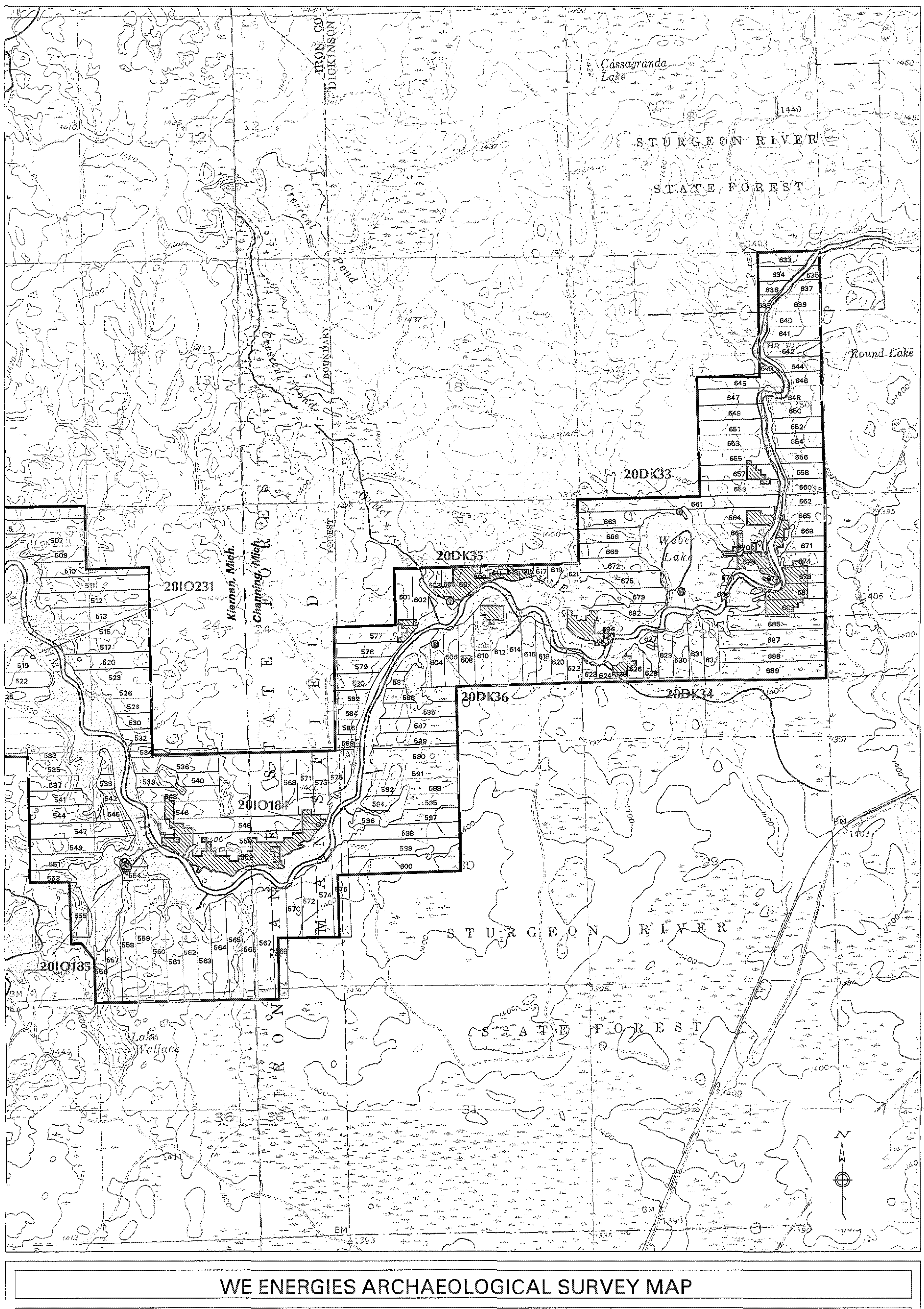

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SCALE 1" = 2000 feet

WAY DAM and MICHIGAMME RESERVOIR

Map Classification

Project Location
Lakes and Rivers
Higher Probability Area
Quadrangle Boundary
Streams
Original River Course

Archaeological Site Location

Historic
Ore Exploration Pit
Prehistoric

Survey Type

Surveyed in 1998 or 1999
Surveyed in 2001
Timber sale

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SHEET A-4

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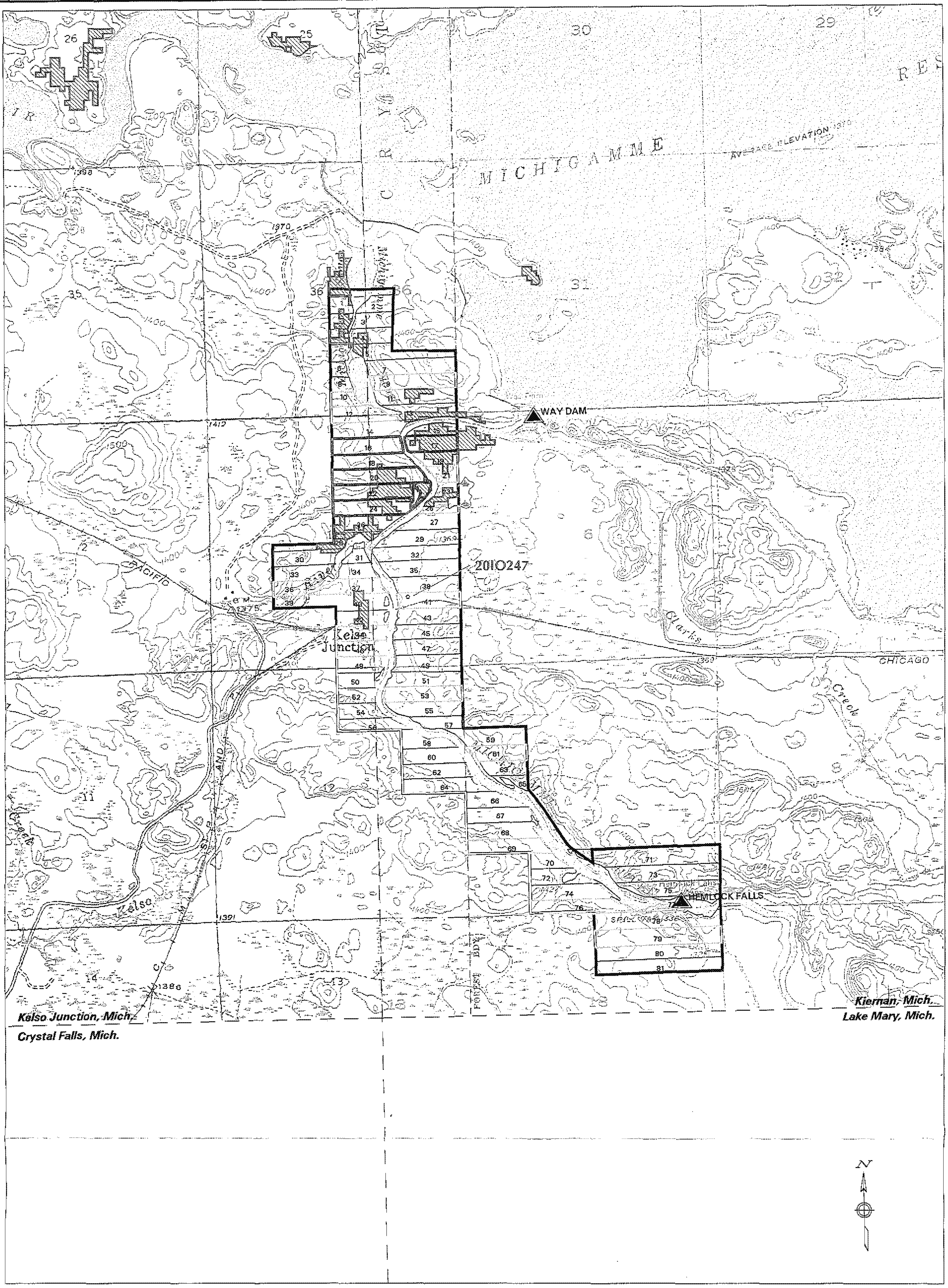

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SCALE 1" = 2000 feet

HEMLOCK FALLS

Map Classification

Project Location
Quadrangle Boundary
Lakes and Rivers
Streams
Higher Probability Area
Original River Course

Archaeological Site Location

Historic
Ore Exploration Pit
Prehistoric

Survey Type

Surveyed in 1998 or 1999
Surveyed in 2001
Timber sale

Job Number: W24 - 96J
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SHEET A-5

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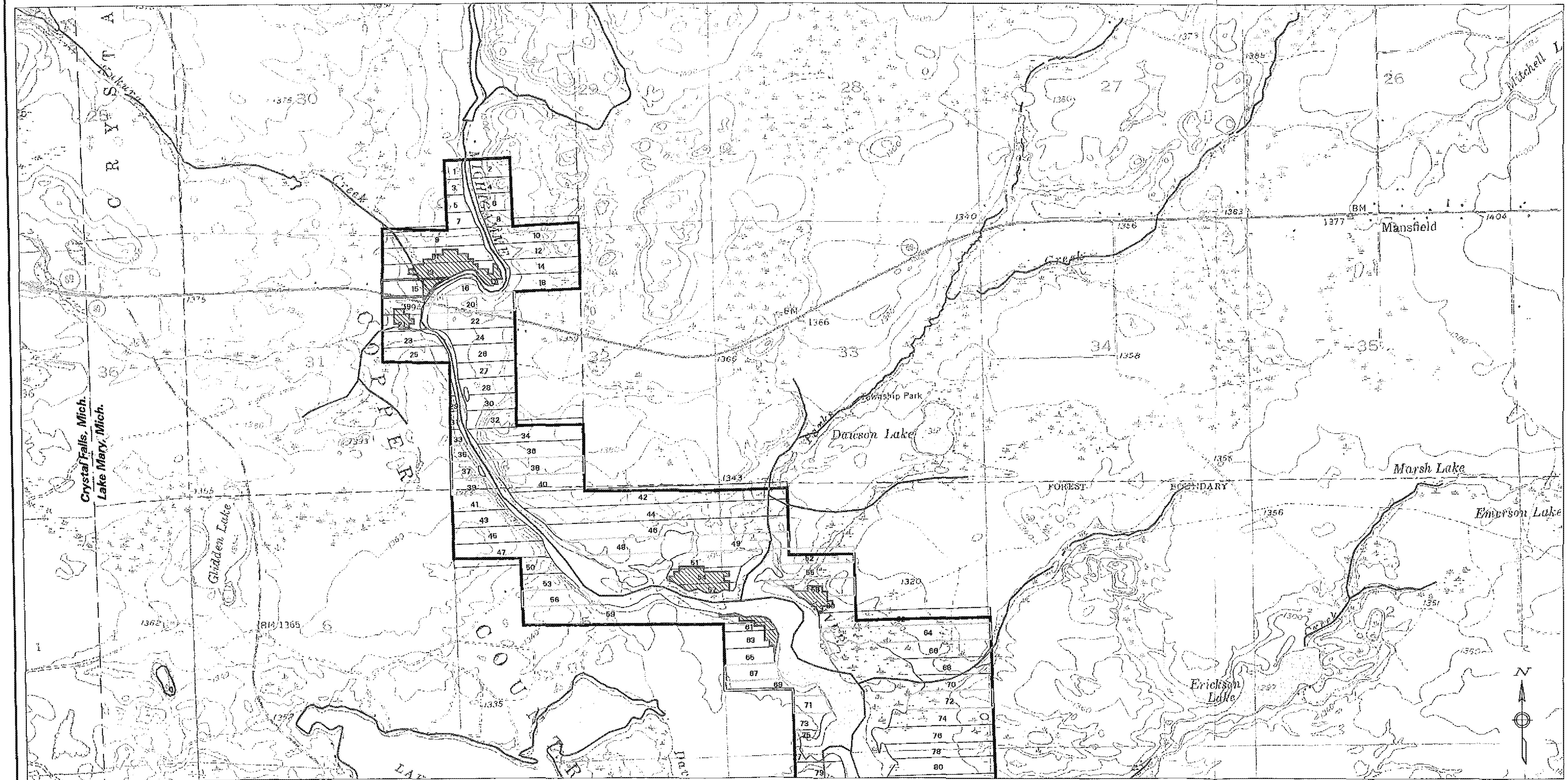

WE ENERGIES ARCHAEOLOGICAL SURVEY MAP

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SCALE 1" = 2000 feet

PEAVY FALLS

Archaeological Site Location

- Historic
- Ore Exploration Pit
- Prehistoric

Survey Type

- Surveyed in 1998 or 1999
- Surveyed in 2001
- Timber sale

Map Classification

- Project Location
- Quadrangle Boundary
- Lakes and Rivers
- Streams
- Higher Probability Area
- Original River Course

MEAD & HUNT ENGINEERS ARCHITECTS SCIENTISTS PLANNERS

AVD Archaeological Services, Inc.

SHEET A-6

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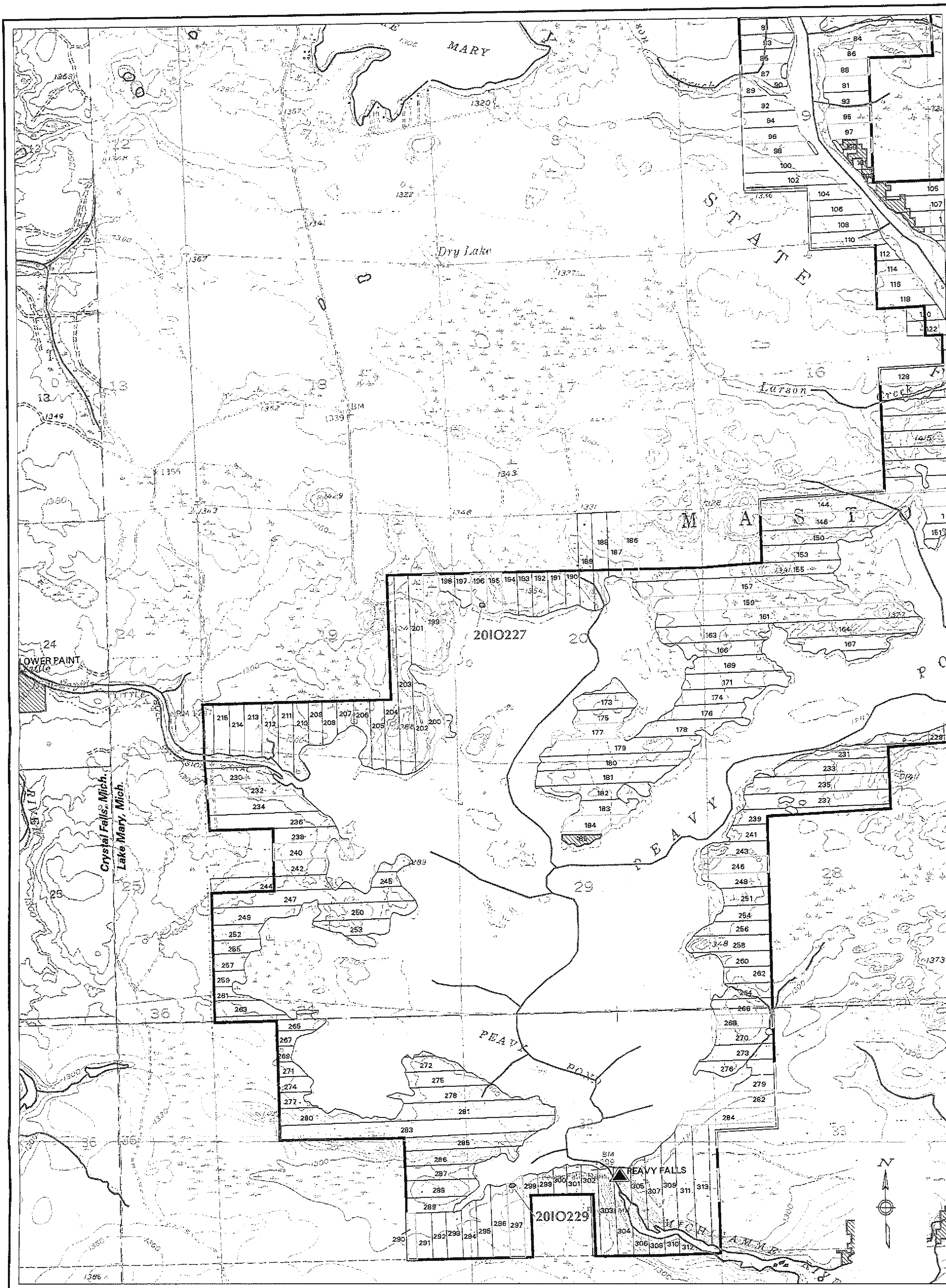

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SCALE 1" = 2000 feet

PEAVY FALLS

Map Classification

Project Location | Lakes and Rivers | Higher Probability Area

Quadrangle Boundary | Streams | Original River Course

Archaeological Site Location

Historic | Ore Exploration Pit | Prehistoric

Survey Type

Surveyed in 1998 or 1999 | Surveyed in 2001 | Timber sale

Job Number: W24 - 96J

Date: 05/23/02

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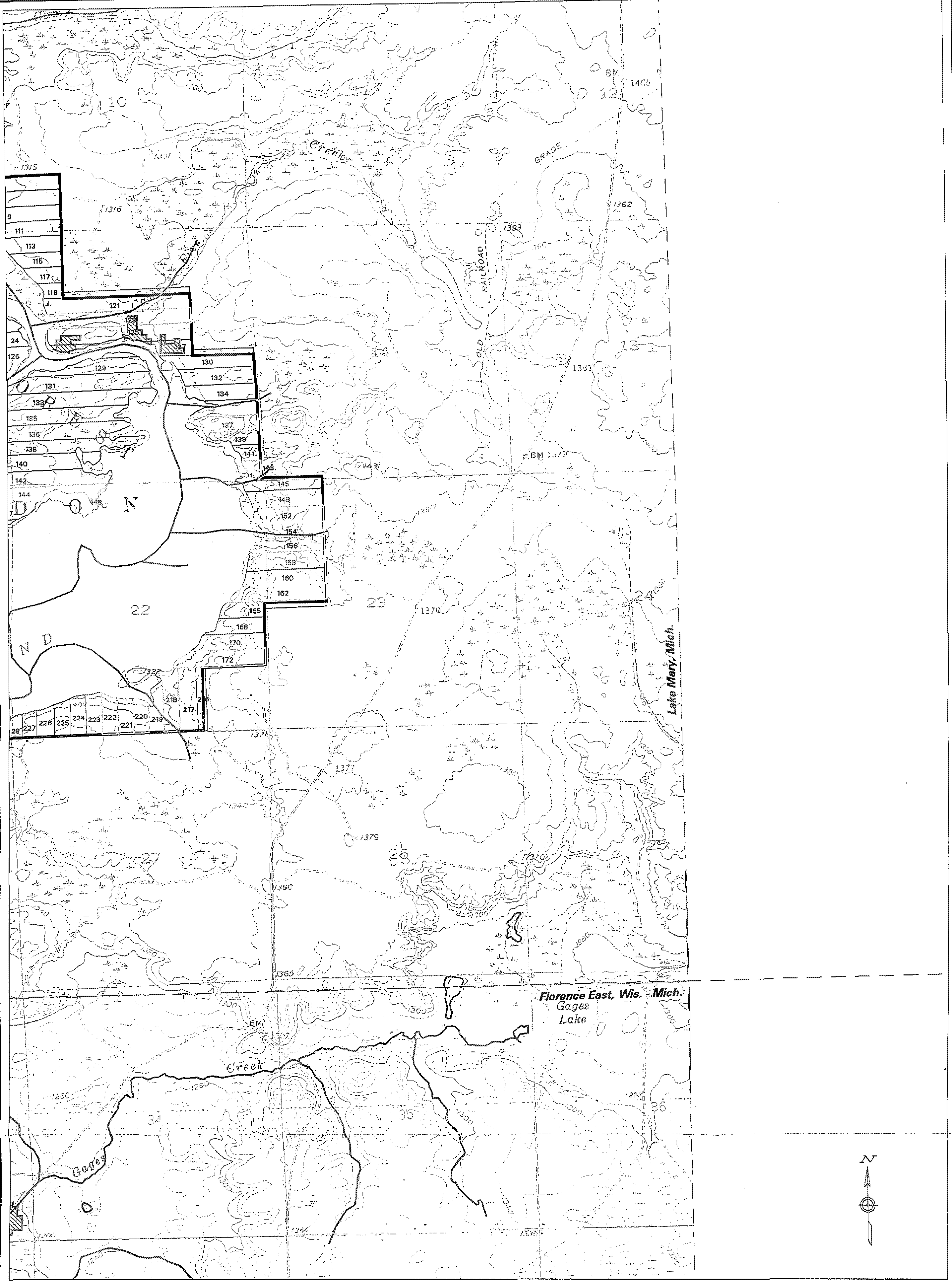
SHEET A-7

MEAD & HUNT ENGINEERS ARCHITECTS SCIENTISTS PLANNERS

AVD Archaeological Services, Inc.



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SCALE 1" = 2000 feet

PEAVY FALLS

Map Classification

Project Location · Lakes and Rivers · Higher Probability Area · Quadrangle Boundary · Streams · Original River Course

Archaeological Site Location

Historic · Ore Exploration Pit · Prehistoric

Survey Type

Surveyed in 1988 or 1999 · Surveyed in 2001 · Timber sale

Job Number: W24 - 96J
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SHEET A-8

MEAD & HUNT ENGINEERS ARCHITECTS SCIENTISTS PLANNERS

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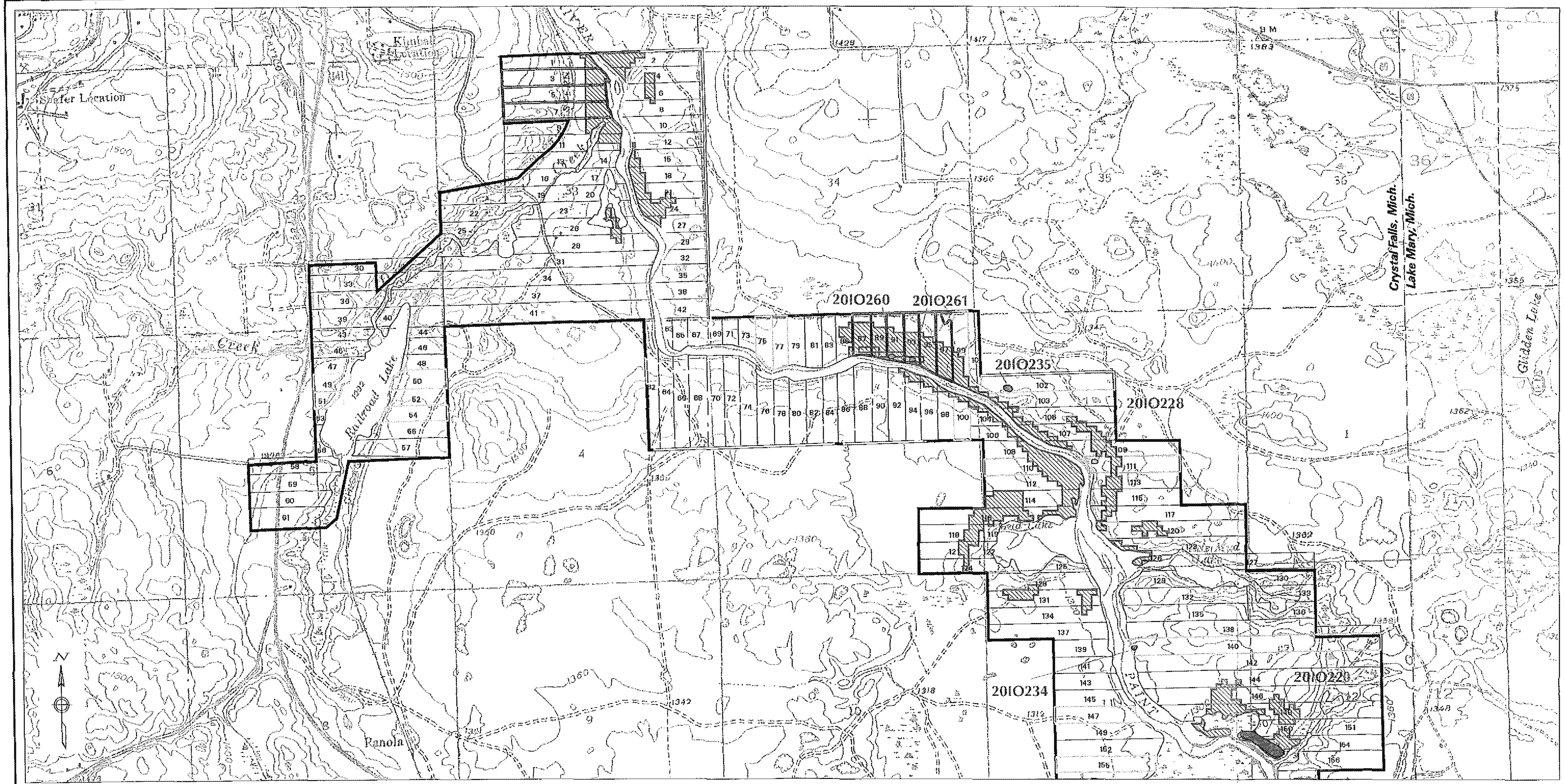
Archaeological Services, Inc.



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SCALE 1" = 2000 feet

LOWER PAINT

Archaeological Site Location
- Historic
- Ore Exploration Pit
- Prehistoric

Survey Type
- Surveyed in 1998 or 1999
- Surveyed in 2001
- Timber sale

Map Classification
- Project Location
- Quadrangle Boundary
- Lakes and Rivers
- Streams
- Higher Probability Area
- Original River Course

MEAD & HUNT
ENGINEERS ARCHITECTS SCIENTISTS PLANNERS

AVD
Archaeological Services, Inc.

SHEET A-9

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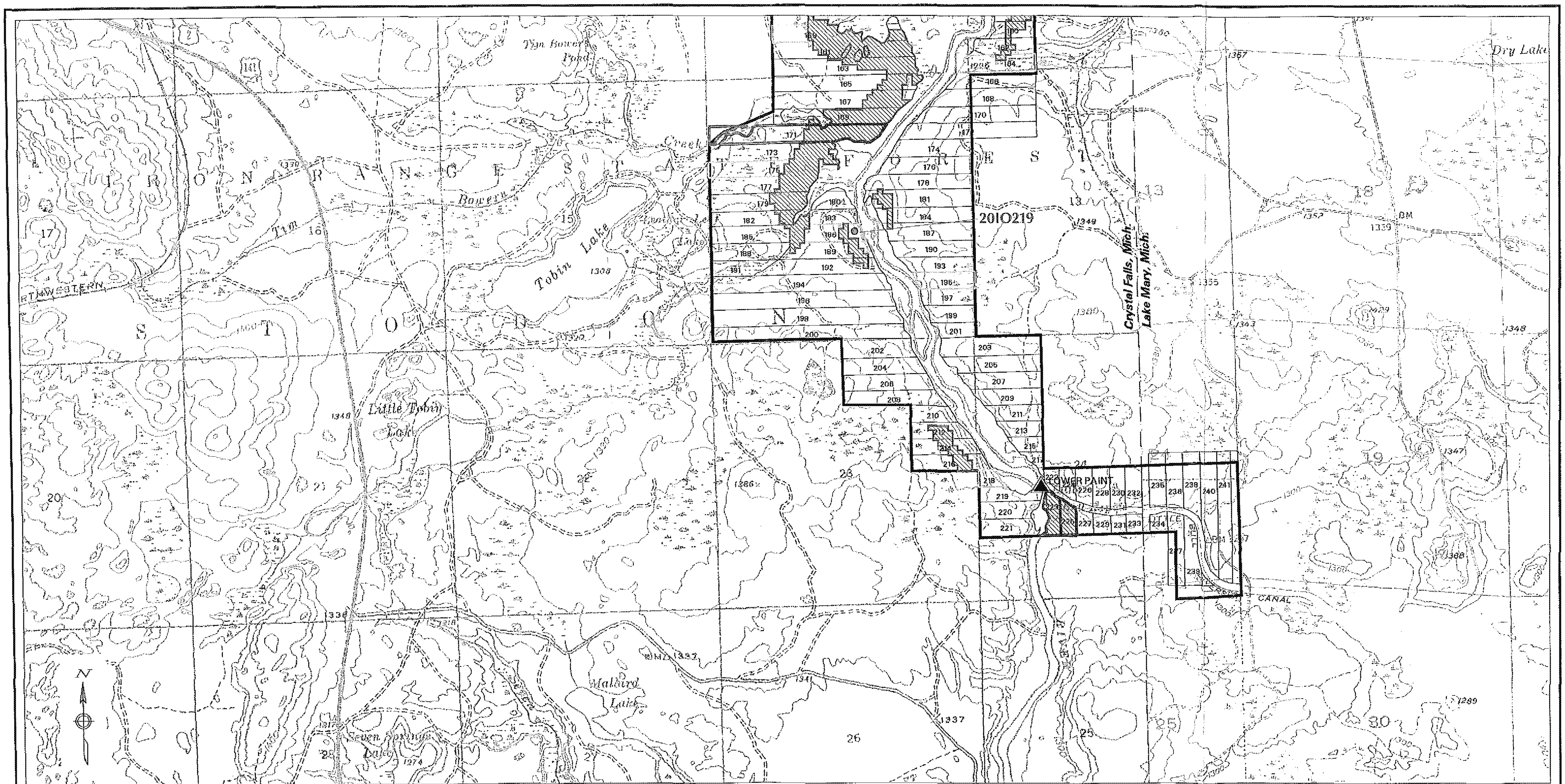

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SCALE 1" = 2000 feet

LOWER PAINT

Archaeological Site Location
- Historic
- Ore Exploration Pit
- Prehistoric

Survey Type
- Surveyed in 1998 or 1999
- Surveyed in 2001
- Timber sale

Map Classification
- Project Location
- Quadrangle Boundary
- Lakes and Rivers
- Streams
- Higher Probability Area
- Original River Course

MEAD & HUNT ENGINEERS ARCHITECTS SCIENTISTS PLANNERS

AVD Archaeological Services, Inc.

SHEET A-10

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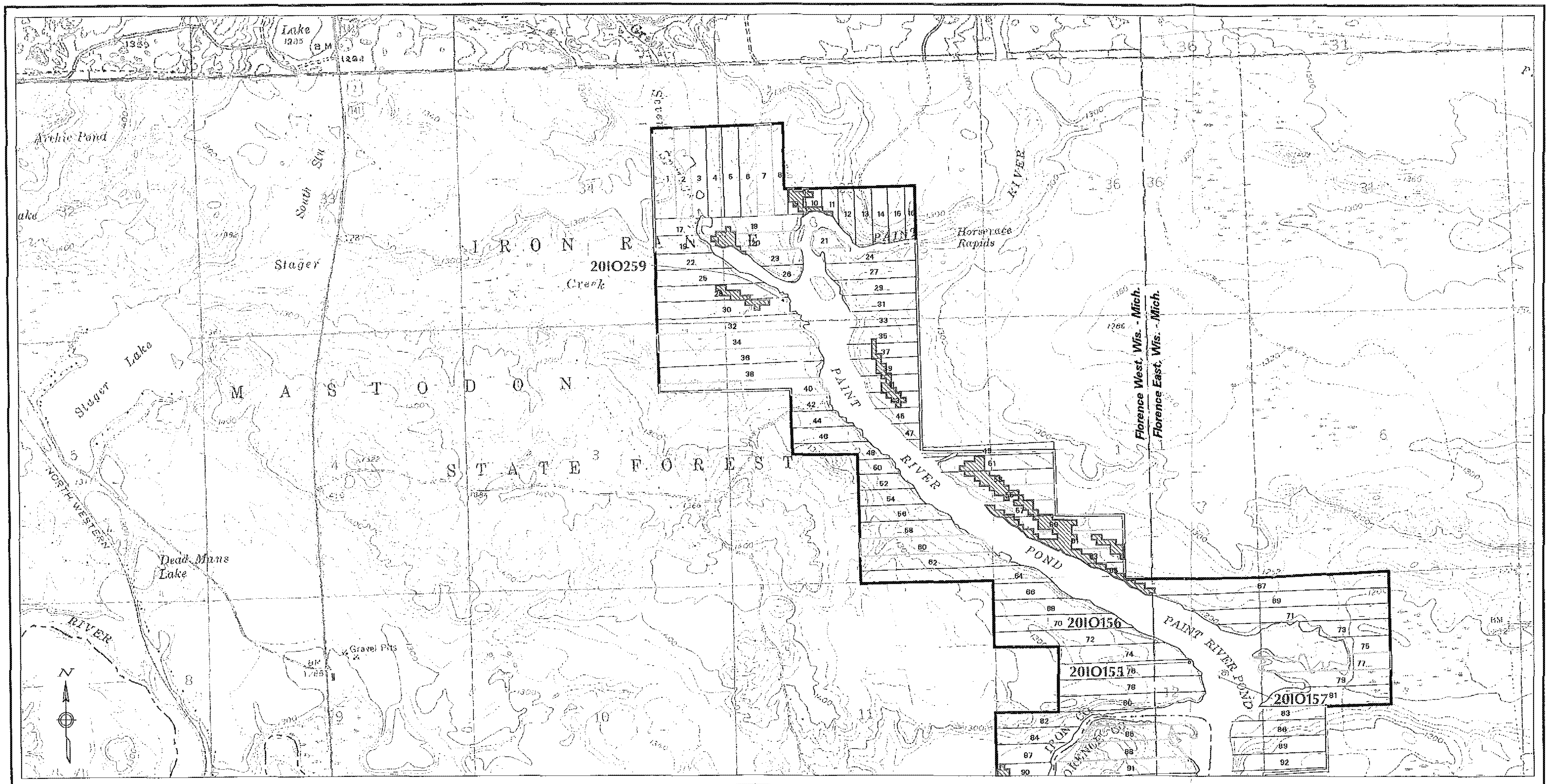

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SCALE 1" = 2000 feet

BRULE

Archaeological Site Location

Historic

Ore Exploration Pit

Prehistoric

Survey Type

Surveyed in 1998 or 1999

Surveyed in 2001

Timber sale

Map Classification

Project Location

Quadrangle Boundary

Lakes and Rivers

Streams

Higher Probability Area

Original River Course

MEAD & HUNT ENGINEERS ARCHITECTS SCIENTISTS PLANNERS

AVD Archaeological Services, Inc.

SHEET A-11

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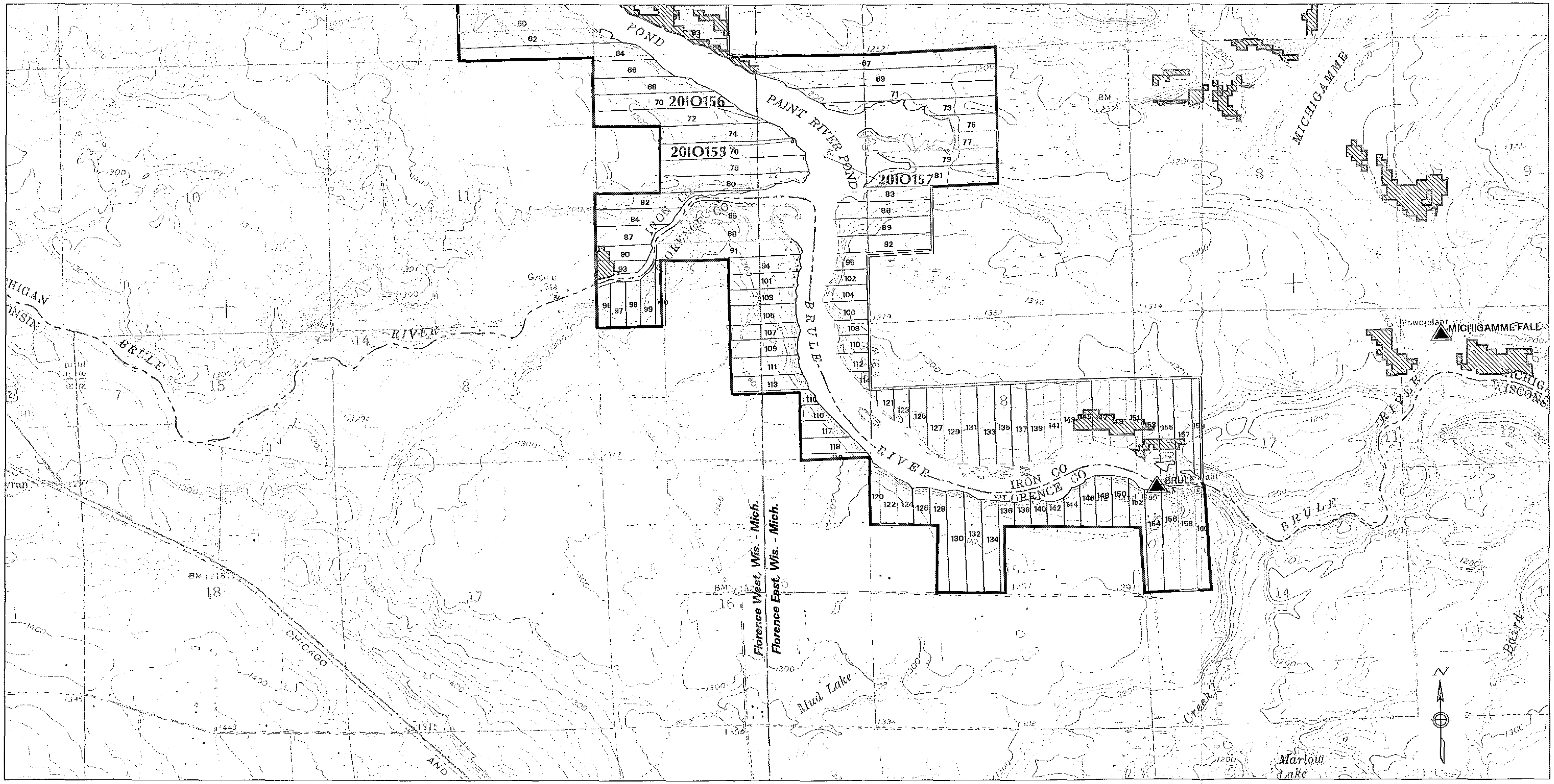

WE ENERGIES ARCHAEOLOGICAL SURVEY MAP

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SCALE 1" = 2000 feet

BRULE

Archaeological Site Location

- Historic
- Ore Exploration Pit
- Prehistoric

Survey Type

- Surveyed in 1998 or 1999
- Surveyed in 2001
- Timber sale

Map Classification

- Project Location
- Quadrangle Boundary
- Lakes and Rivers
- Streams
- Higher Probability Area
- Original River Course

MEAD & HUNT ENGINEERS ARCHITECTS SCIENTISTS PLANNERS

AVD Archaeological Services, Inc.

SHEET A-12

Job Number: W24-96J
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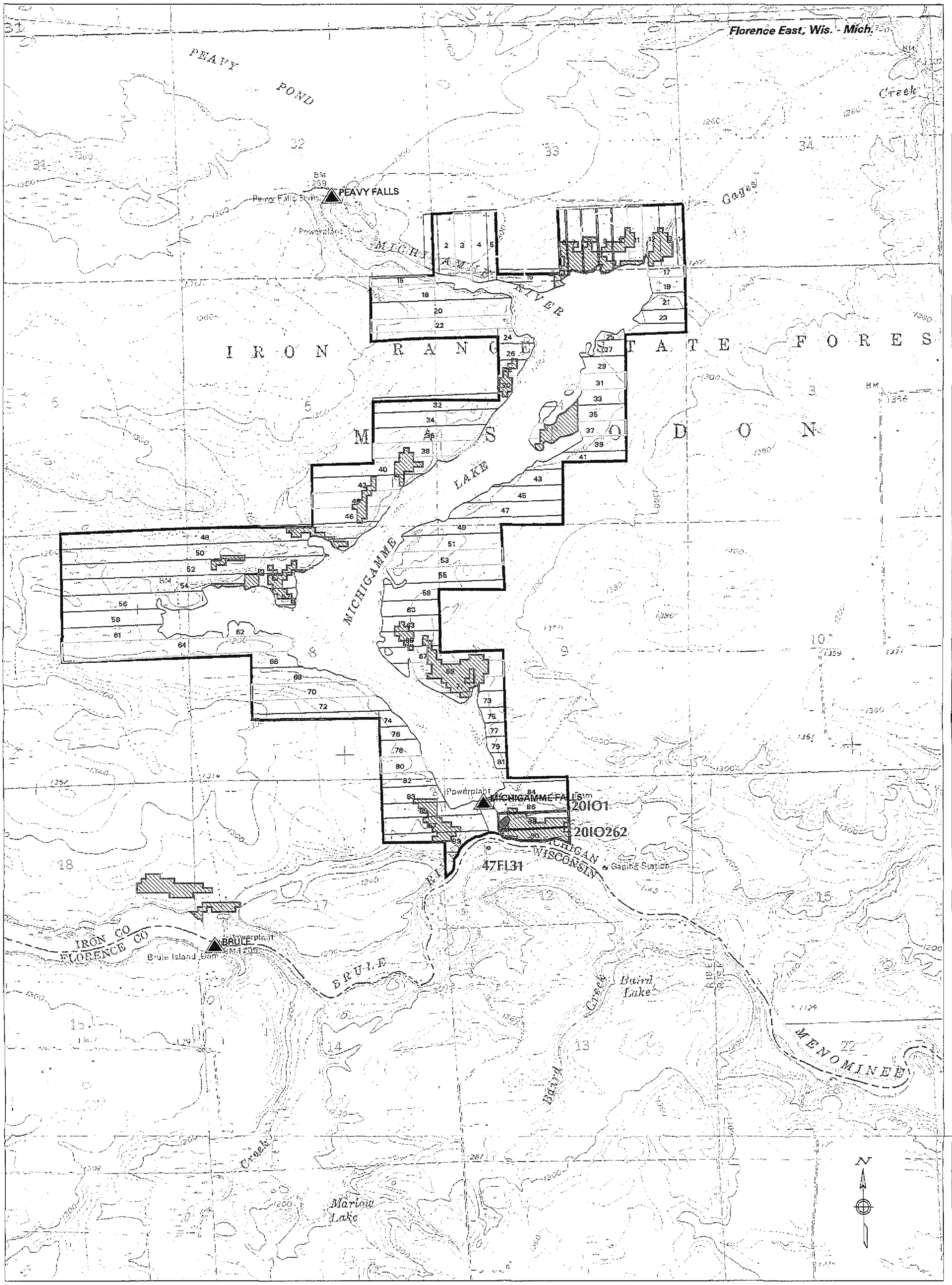

WE ENERGIES ARCHAEOLOGICAL SURVEY MAP

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SCALE 1" = 2000 feet

Map Classification
Project Location
Lakes and Rivers
Higher Probability Area
Quadrangle Boundary
Streams
Original River Course

Archaeological Site Location
Historic
Ore Exploration Pit
Prehistoric

Survey Type
Surveyed in 1998 or 1999
Surveyed in 2001
Timber sale

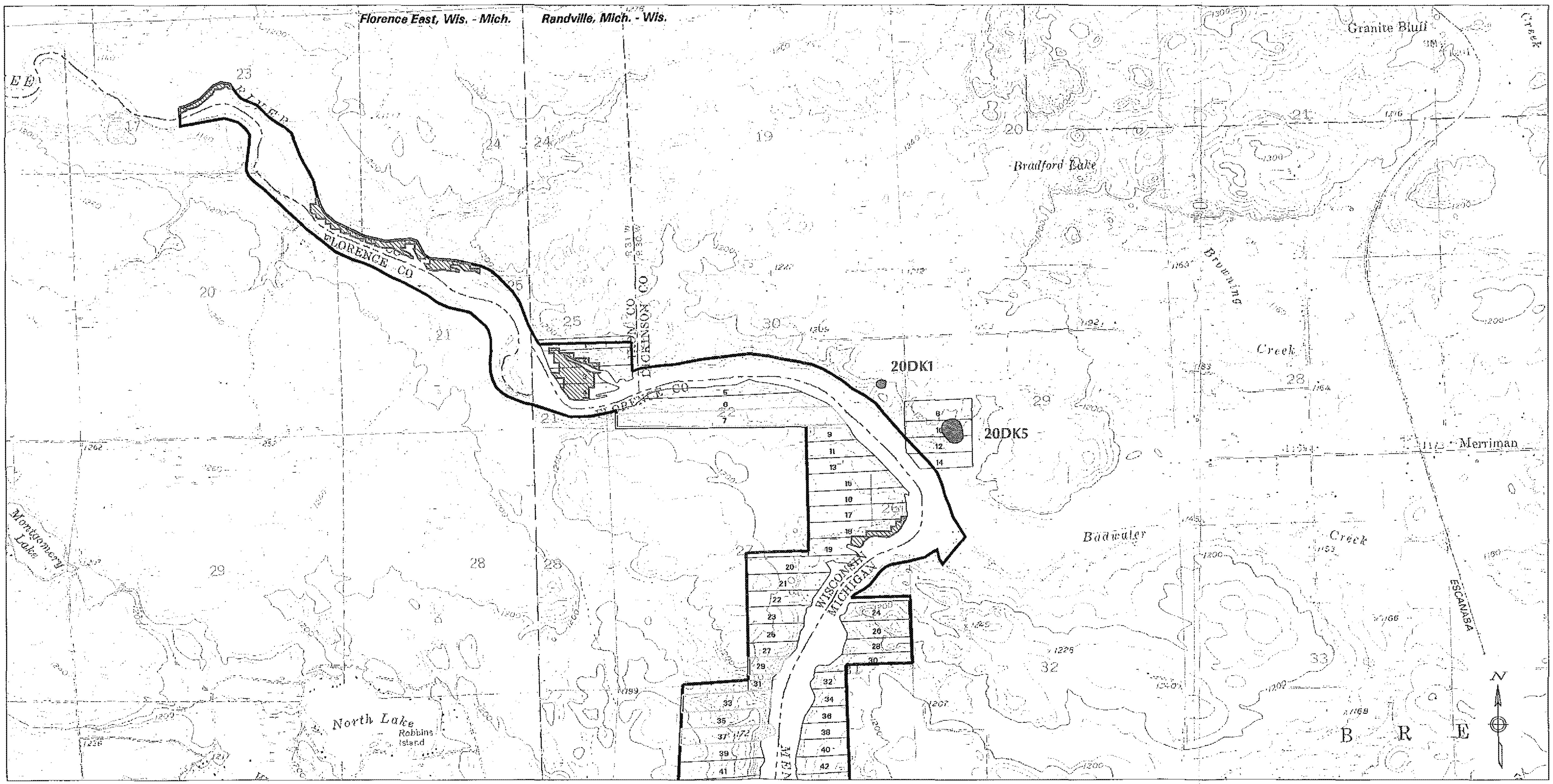
Job Number: W24 - 96J
Date: 05/23/02
Macro: ./W24/96J/archeo/ /maps02/makemaps.aml

SHEET A-13

MICHIGAMME FALLS

MEAD & HUNT ENGINEERS ARCHITECTS SCIENTISTS PLANNERS

AVD Archaeological Services, Inc.



WE ENERGIES ARCHAEOLOGICAL SURVEY MAP

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SCALE 1" = 2000 feet

TWIN FALLS

Archaeological Site Location
- Historic
- Ore Exploration Pit
- Prehistoric

Survey Type
- Surveyed in 1998 or 1999
- Surveyed in 2001
- Timber sale

Map Classification
- Project Location
- Quadrangle Boundary
- Lakes and Rivers
- Streams
- Higher Probability Area
- Original River Course

MEAD & HUNT ENGINEERS ARCHITECTS SCIENTISTS PLANNERS

AVD Archaeological Services, Inc.

SHEET A-14

Job Number: W24-96J
05/23/02
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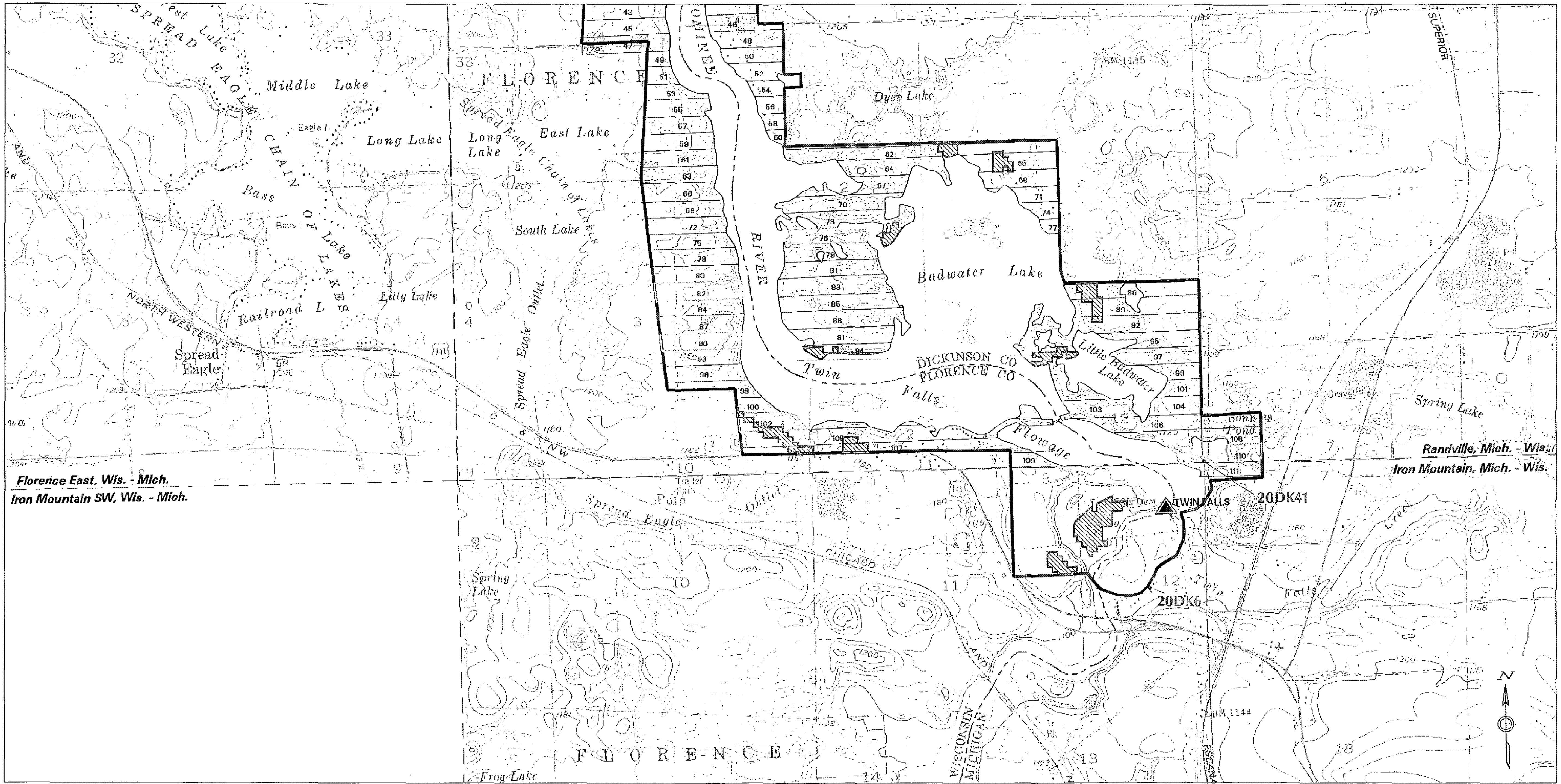

WE ENERGIES ARCHAEOLOGICAL SURVEY MAP

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1 .5 0 1 kilometer

SCALE 1" = 2000 feet

TWIN FALLS

Archaeological Site Location

- Historic
- Ore Exploration Pit
- Prehistoric

Survey Type

- Surveyed in 1998 or 1999
- Surveyed in 2001
- Timber sale

Map Classification

- Project Location
- Quadrangle Boundary
- Lakes and Rivers
- Streams
- Higher Probability Area
- Original River Course

MEAD & HUNT ENGINEERS ARCHITECTS SCIENTISTS PLANNERS

AVD Archaeological Services, Inc.

SHEET A-15

Job Number: W24-96J
05/23/02
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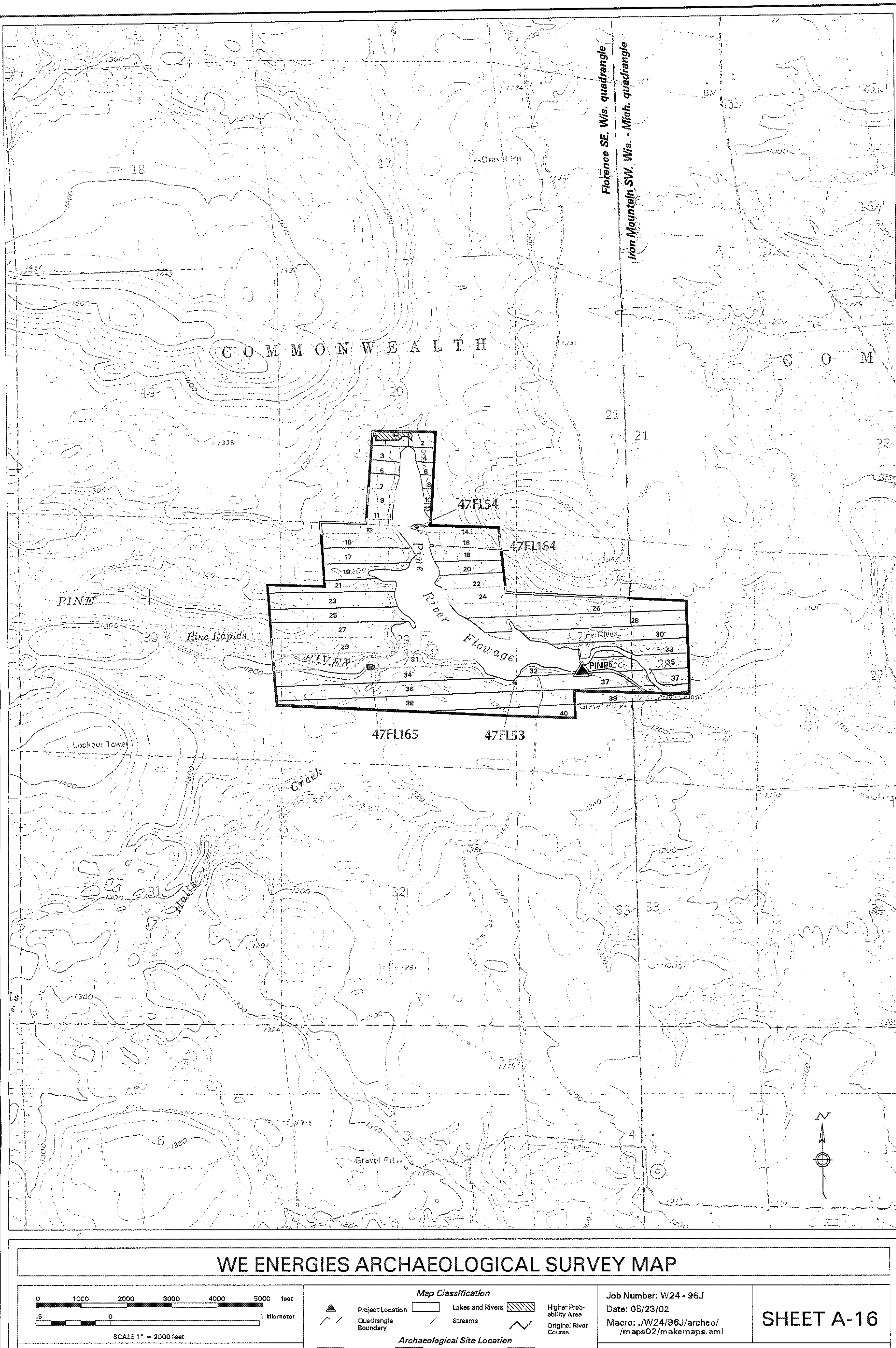

WE ENERGIES ARCHAEOLOGICAL SURVEY MAP

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SCALE 1" = 2000 feet

PINE

Map Classification

Project Location
Lakes and Rivers
Higher Probability Area
Quadrangle Boundary
Streams
Original River Course

Archaeological Site Location

Historic
Ore Exploration Pit
Prehistoric

Survey Type

Surveyed in 1998 or 1999
Surveyed in 2001
Timber sale

Job Number: W24 - 96J
Date: 05/23/02
Macro: ../W24/96J/archeo/
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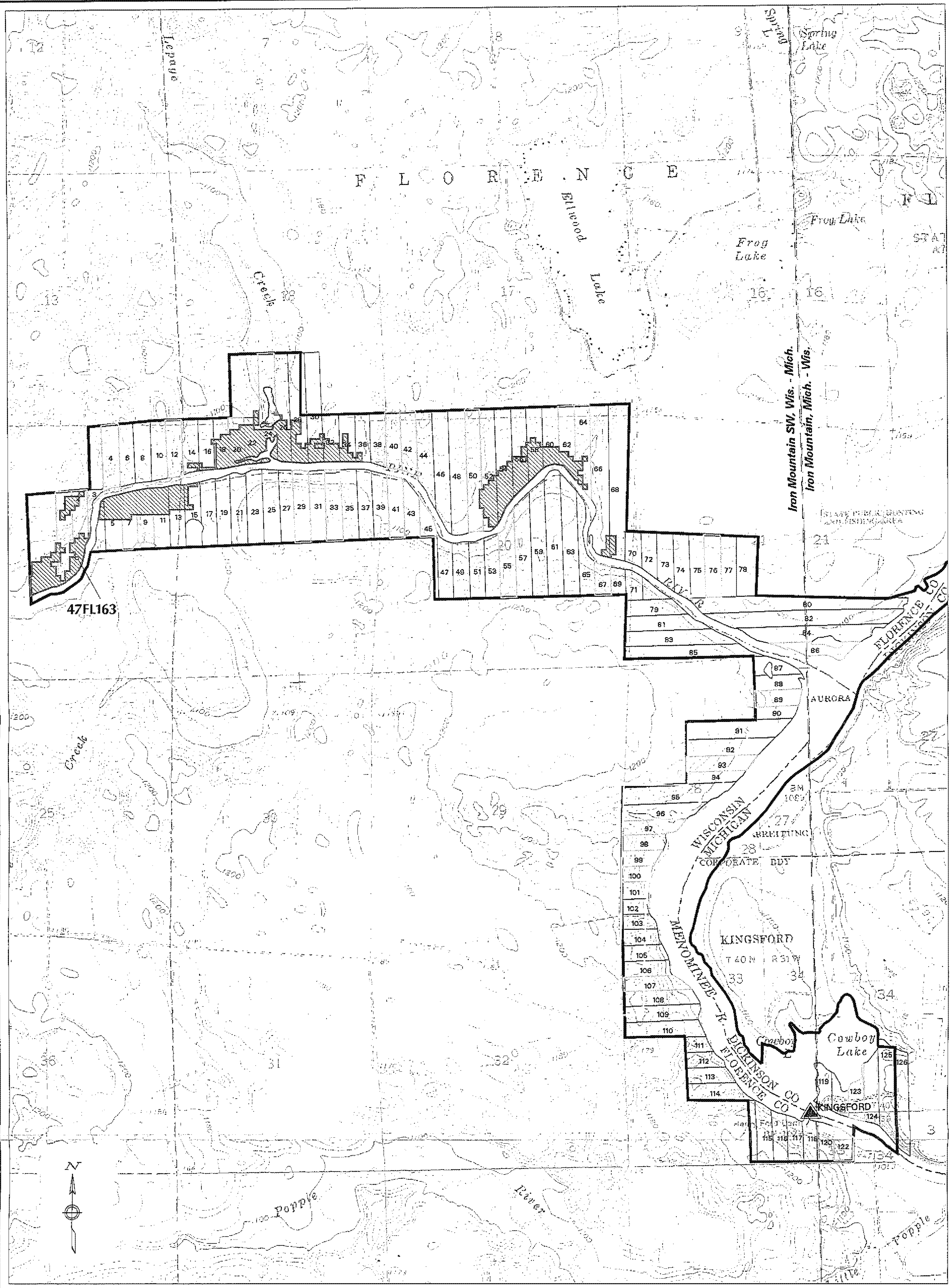
SHEET A-16

MEAD & HUNT ENGINEERS ARCHITECTS SCIENTISTS PLANNERS

AVD
Archaeological Services, Inc.



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SCALE 1" = 2000 feet

Map Classification
Project Location
Lakes and Rivers
Higher Probability Area
Quadrangle Boundary
Streams
Original River Course

Archaeological Site Location
Historic
Ore Exploration Pit
Prehistoric

Survey Type
Surveyed in 1998 or 1999
Surveyed in 2001
Timber sale

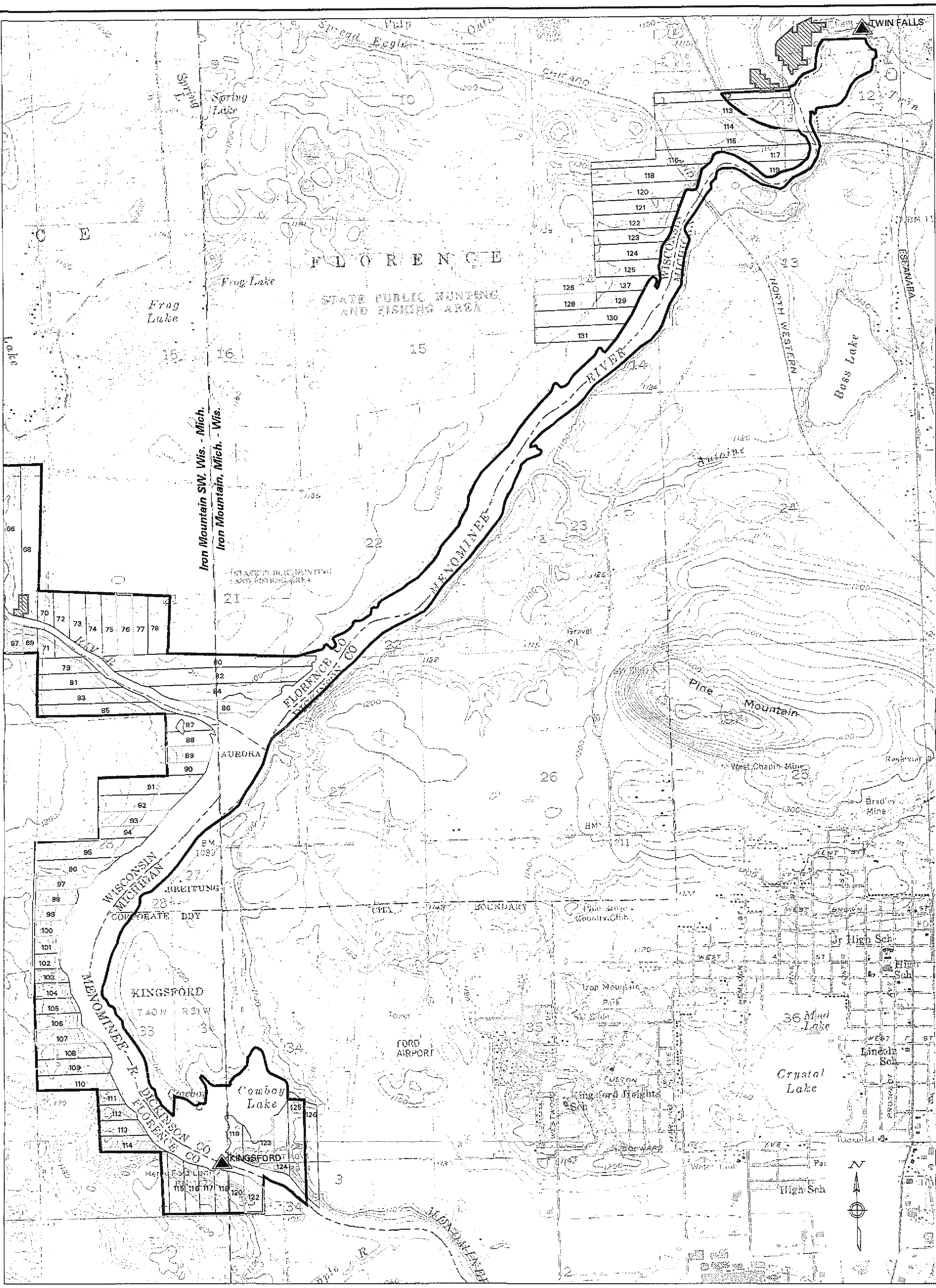
Job Number: W24 - 96J
Date: 05/23/02
Macro: ./W24/96J/archeo/ /maps02/makemaps.aml

SHEET A-17

KINGSFORD

MEAD & HUNT Engineers Architects Scientists Planners

AVD Archaeological Services, Inc.



WE ENERGIES ARCHAEOLOGICAL SURVEY MAP

0 1000 2000 3000 4000 5000 feet

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SCALE 1" = 2000 feet

KINGSFORD

Map Classification

Project Location — Lakes and Rivers — Higher Probability Area

Quadrangle Boundary — Streams — Original River Course

Archaeological Site Location

Historic — Ore Exploration Pit — Prehistoric

Survey Type

Surveyed in 1998 or 1999 — Surveyed in 2001 — Timber sale

Job Number: W24 - 96J

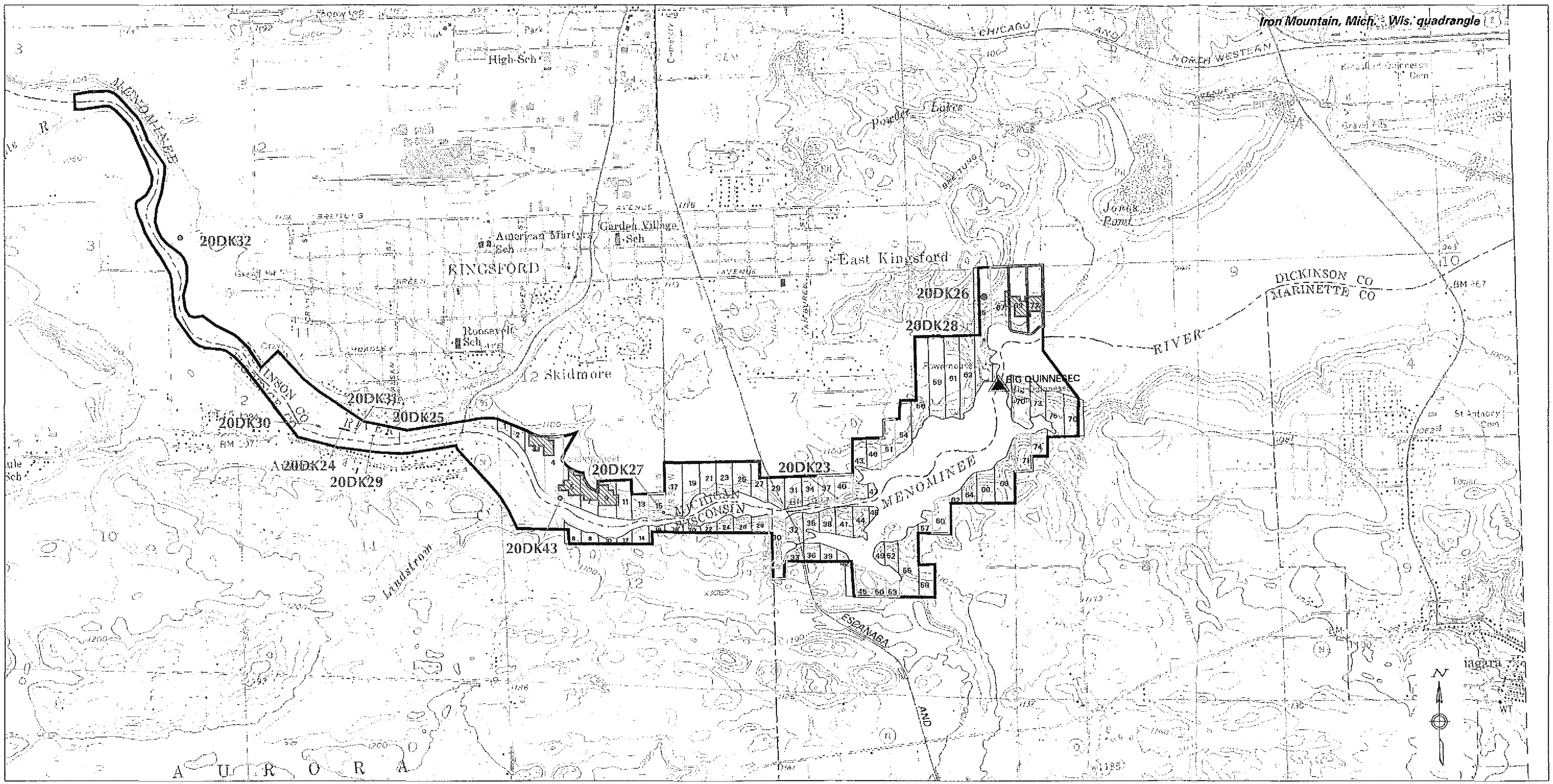
Date: 05/23/02

Macro: ./W24/96J/archeo//maps02/makemaps.aml

SHEET A-18

MEAD & HUNT ENGINEERS ARCHITECTS SCIENTISTS PLANNERS

AVD Archaeological Services, Inc.



WE ENERGIES ARCHAEOLOGICAL SURVEY MAP

SCALE 1" = 2000 feet

BIG QUINNESEC FALLS

Archaeological Site Location
- Historic
- Ore Exploration Pit
- Prehistoric

Survey Type
- Surveyed in 1998 or 1999
- Surveyed in 2001
- Timber sale

Map Classification
- Project Location
- Quadrangle Boundary
- Lakes and Rivers
- Streams
- Higher Probability Area
- Original River Course

MEAD & HUNT Engineers Architects Scientists Planners

AVD Archaeological Services, Inc.

SHEET A-19

Job Number: W24-96J
05/23/02
Macro: ./W24/96J/archeo/ /maps02/makemaps.aml

Table 1: Known Prehistoric Sites Near WE Hydro Projects

SHPO	Project	SHPO	Project
20ME17	WR	20DK23	BQ
20ME2/10	WR	20DK24	BQ
20ME23	WR	20DK25	BQ
20ME3	WR	20DK26	BQ
20ME4	WR	20DK27	BQ
20ME49	WR	20DK28	BQ
20ME61	WR	20DK29	BQ
20ME62	WR	20DK30	BQ
20ME63	WR	20DK32	BQ
20ME68	WR	20DK43	BQ
20ME69	WR		
20ME70	WR	20IO228	LP
20ME71	WR	20IO234	LP
20ME8	WR		
47MT173	WR	20IO1	MF
47MT219	WR	47FL31	MF
47MT234	WR		
47MT235	WR	47FL165	PN
47MT25	WR		
47MT26	WR	20DK5	TF
47MT27	WR	20DK6	TF
47MT35	WR		
47MT37	WR	20DK33	WD
47MT40	WR	20DK34	WD
47MT41	WR	20DK35	WD
47MT42	WR	20DK36	WD
47MT46	WR	20DK42	WD
47MT96	WR	20IO184	WD
47MT97	WR	20IO185	WD
47MT98	WR	20IO186	WD
		20IO187	WD
20ME13	CH	20IO238	WD
20ME14	CH	20IO239	WD
20ME15	CH	20IO240	WD
20ME16	CH	20IO241	WD
20ME47	CH	20IO242	WD
20ME50	CH	20IO243	WD
20ME6	CH	20IO244	WD
20ME65	CH	20IO245	WD
20ME66	CH	20IO246	WD
2ME9	CH		
47MT218	CH	20IO155	BR
47MT220	CH	20IO156	BR
47MT221	CH	20IO157	BR
47MT222	CH	**n = 38**	
n = 44			
WR=	Rapids		
CH=	Chalk Hill	**N=82**	
BQ=	Quinnesec		
LP=	Lower Paint		
MF=	e Falls		
PN=	Pine		
TF=	Twin Falls		
WD=	Way Dam		
Br=	Bruie		

Table 2: Sites Used for Model Development

SHPO#	Project	Site Type	Culture	Descriptions/relevant information
20DK24	BQ	Campsite/village	Unk prehis/Archaic?	shore camp, small features & lithics, limited testing
20DK25	BQ	Cache/pit/hearth-Camp/village	Unk prehist/Archaic/Wdld	a low rise of sand with very deep features
20DK26	BQ	Unknown	Unk prehist/Paleo-Indian	subsurface lithics, no features
20DK27	BQ	Other - portage	L. Wdld/Archaic?/Euro-A	terminus of portage. Historic and Late Woodland artifacts
20DK28	BQ	Dam-hist earthwork/portage	Unk Pre/Hist. Ind/E-A	portage, possible dam location, disturbed-dam construction
20DK29	BQ	Campsite/village	Unknown prehistoric	small shore site with lithic features
20DK30	BQ	Lithic scatter	Unknown prehistoric	quartz, quartzite, and chert flks found on trail
20DK43	BQ	Campsite/village	Unknown prehistoric	4 positive ST, 7 chert flks, 5 quartz, 9 calc. bone frags
20IO220	LP	Village	Middle & Late Woodland	30' high ridge - 800' W of small tributary. 7,000+ artifacts
20IO228	LP	Camp/village-Lithic scatter	Unknown prehistoric	on river edge; some logging disturbance
20IO234	LP	Camp/village-Lithic scatter	Unknown prehistoric	north of an inside meander, a low flat terrace
20IO1	MF	Lithic scatter	Woodland	quartz workshops, much debitage, tool kit materials
47FL31	MF	Camp/village-Lithic scatter	Woodland	bone, quartz point, quartz and chert flks
47FL165	PN	Camp/vil-Lithic scatter-found'n	Unk prehis/historic	prehist. camp, historic struc. - earthen berm nearby
20DK6	TF	Lithic scatter	Unknown prehistoric	near Menominee & creek confl. lithic debris, 15 cm deep
20DK33	WD	Habitation	Unknown prehistoric	many quartz, some flint, FCR; sometimes inundated
20DK34	WD	Habitation	Woodland	lower water level; 4 triang. & 1 point/blade-broken stem
20DK35	WD	Habitation	Unknown prehistoric	1 quartz blade, many flks, many FCR
20DK36	WD	Habitation	Unknown prehistoric	at lower water; quartz knife, flks & cores, FCR, fire pits
20DK42	WD	Habitation	Woodland	FCR, quartz flks 1 quartz point, 1 chert blade
20IO184	WD	Habitation	Unknown prehistoric	quartz flks & cores, flint flks, FCR
20IO185	WD	Habitation	Unknown prehistoric	flint knife, flint flks, quartz flks & cores, FCR
20IO186	WD	Habitation	Archaic	Brewerton quartz point, quartz knife, quartz flks & chopper, FCR
20IO187	WD	Habitation	Unknown prehistoric	quartz flks & cores, flint flks, FCR, fire pits
20IO238	WD	Habitation	Unknown prehistoric	1 Hixton blade
20IO239	WD	Habitation	Unknown prehistoric	FCR, quartz flks & 23 pieces of copper
20IO240	WD	Habitation	Unknown prehistoric	FCR, quartz flks and broken quartzite blade
20IO241	WD	Habitation	Unknown prehistoric	FCR, quartz, 1 copper awl; 2 areas of FCR at site
20IO243	WD	Habitation	Unknown prehistoric	FCR, quartz flks and 1 copper tool
20IO244	WD	Habitation	Unknown prehistoric	FCR, quartz flks and 1 small copper piece
20IO245	WD	Habitation	Woodland	2 triangular projectile points
20IO246	WD	Habitation	Unknown prehistoric	FCR, quartz flks, 7 pcs copper

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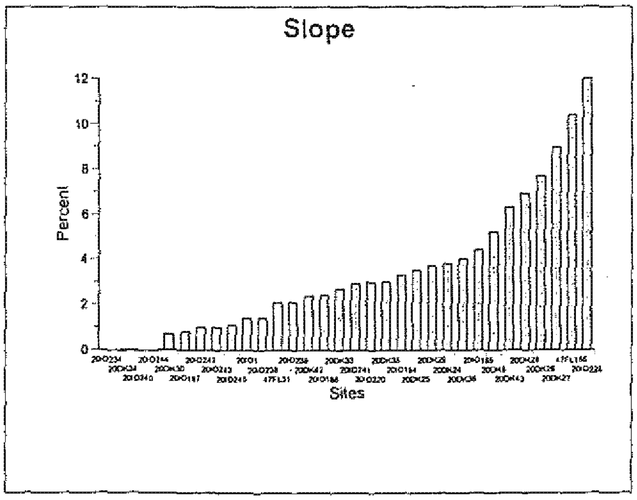
FCR= fire-cracked rock ST=shovel test flks=flakes

Table 3: Sorted by Slope

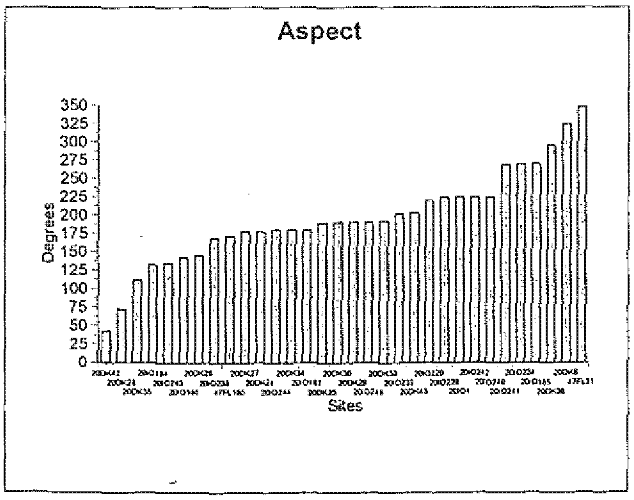
SHPO#	Project	Slope	Aspect	Elev.	1st H2O	2nd H2O	
20IO234	LP	0.0	270	1300	100	3090	
20DK34	WD	0.0	180	1370	50	1160	
20IO240	WD	0.0	225	1370	500	2950	
20IO244	WD	0.0	180	1370	250	1900	
20DK30	BQ	0.7	190	1032	100	2600	
20IO187	WD	0.8	180	1370	400	1855	
20IO242	WD	1.0	225	1370	450	1500	
20IO243	WD	1.0	135	1370	1100	2000	
20IO246	WD	1.1	190	1370	1	1825	
20IO1	MF	1.4	225	1131	100	1067	
20IO238	WD	1.4	169	1372	1	2930	
47FL31	MF	2.1	348	1137	100	782	
20IO239	WD	2.1	202	1371	100	2910	
20DK42	WD	2.4	43	1375	50	400	
20IO186	WD	2.4	142	1370	800	2050	
20DK33	WD	2.7	192	1377	50	895	
20IO241	WD	2.9	268	1373	400	2620	
20IO220	LP	3.0	220	1300	20	20	
20DK35	WD	3.0	112	1375	50	1345	
20IO184	WD	3.3	133	1377	50	1020	
20DK25	BQ	3.5	189	1034	100	1250	
20DK29	BQ	3.7	190	1032	100	1530	
20DK24	BQ	3.8	178	1034	100	2066	
20DK36	WD	4.0	296	1383	200	760	
20IO185	WD	4.4	270	1385	100	1200	78.1%
20DK6	TF	5.2	325	1085	100	140	
20DK43	BQ	6.3	203	1034	100	650	
20DK28	BQ	6.9	73	969	100	1000	
20DK26	BQ	7.7	145	1058	575	1830	
20DK27	BQ	9.0	178	1026	100	600	
47FL165	PN	10.4	172	1212	100	80	
20IO228	LP	12.0	224	1335	100	805	
32							



mean	3.4
std. dev.	3.0

Table 4: Sorted by Aspect

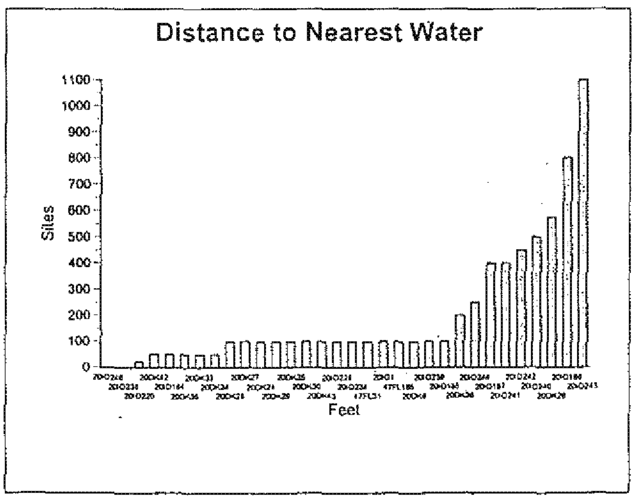
SHPO#	Project	Slope	Aspect	Elev.	1st H2O	2nd H2O	
20DK42	WD	2.4	43	1375	50	400	
20DK28	BQ	6.9	73	969	100	1000	
20DK35	WD	3.0	112	1375	50	1345	
20IO184	WD	3.3	133	1377	50	1020	
20IO243	WD	1.0	135	1370	1100	2000	
20IO186	WD	2.4	142	1370	800	2050	
20DK26	BQ	7.7	145	1058	575	1830	
20IO238	WD	1.4	169	1372	1	2930	
47FL165	PN	10.4	172	1212	100	80	
20DK27	BQ	9.0	178	1026	100	600	
20DK24	BQ	3.8	178	1034	100	2066	
20IO244	WD	0.0	180	1370	250	1900	
20DK34	WD	0.0	180	1370	50	1160	
20IO187	WD	0.8	180	1370	400	1855	
20DK25	BQ	3.5	189	1034	100	1250	
20DK30	BQ	0.7	190	1032	100	2600	
20DK29	BQ	3.7	190	1032	100	1530	
20IO246	WD	1.1	190	1370	1	1825	
20DK33	WD	2.7	192	1377	50	895	
20IO239	WD	2.1	202	1371	100	2910	
20DK43	BQ	6.3	203	1034	100	650	
20IO220	LP	3.0	220	1300	20	20	
20IO228	LP	12.0	224	1335	100	805	
20IO1	MF	1.4	225	1131	100	1067	
20IO242	WD	1.0	225	1370	450	1500	
20IO240	WD	0.0	225	1370	500	2950	75.0%
20IO241	WD	2.9	268	1373	400	2620	
20IO234	LP	0.0	270	1300	100	3090	
20IO185	WD	4.4	270	1385	100	1200	
20DK36	WD	4.0	296	1383	200	760	
20DK6	TF	5.2	325	1085	100	140	
47FL31	MF	2.1	348	1137	100	782	
32							



mean 196.0
std. dev. 64.1

Table 5: Sorted by Distance to Nearest Water in Feet

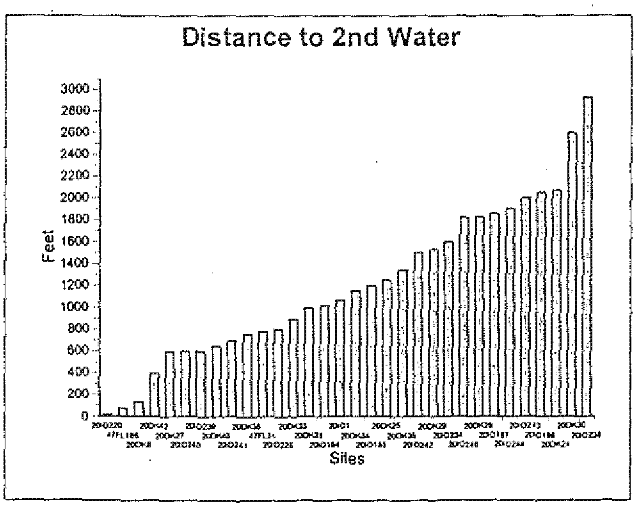
SHPO#	Project	Slope	Aspect	Elev.	1st H2O	2nd H2O	
20IO246	WD	1.1	190	1370	1	1825	
20IO238	WD	1.4	169	1372	1	2930	
20IO220	LP	3.0	220	1300	20	20	
20DK42	WD	2.4	43	1375	50	400	
20IO184	WD	3.3	133	1377	50	1020	
20DK35	WD	3.0	112	1375	50	1345	
20DK33	WD	2.7	192	1377	50	895	
20DK34	WD	0.0	180	1370	50	1160	
20DK28	BQ	6.9	73	969	100	1000	
20DK27	BQ	9.0	178	1026	100	600	
20DK24	BQ	3.8	178	1034	100	2066	
20DK29	BQ	3.7	190	1032	100	1530	
20DK25	BQ	3.5	189	1034	100	1250	
20DK30	BQ	0.7	190	1032	100	2600	
20DK43	BQ	6.3	203	1034	100	650	
20IO228	LP	12.0	224	1335	100	805	
20IO234	LP	0.0	270	1300	100	3090	
47FL31	MF	2.1	348	1137	100	782	
20IO1	MF	1.4	225	1131	100	1067	
47FL165	PN	10.4	172	1212	100	80	
20DK6	TF	5.2	325	1085	100	140	
20IO239	WD	2.1	202	1371	100	2910	
20IO185	WD	4.4	270	1385	100	1200	
20DK36	WD	4.0	296	1383	200	760	
20IO244	WD	0.0	180	1370	250	1900	
20IO187	WD	0.8	180	1370	400	1855	
20IO241	WD	2.9	268	1373	400	2620	
20IO242	WD	1.0	225	1370	450	1500	
20IO240	WD	0.0	225	1370	500	2950	
20DK26	BQ	7.7	145	1058	575	1830	93.8%
20IO186	WD	2.4	142	1370	800	2050	
20IO243	WD	1.0	135	1370	1100	2000	
32							



mean 201.5
std. dev. 244.9

Table 6: Sorted by Distance to Next Nearest Water

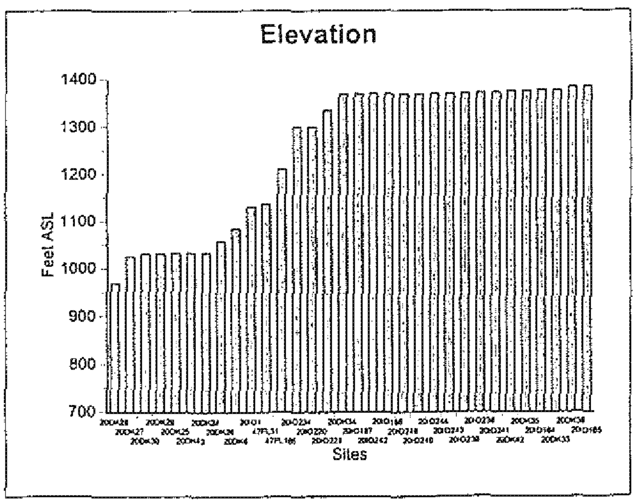
SHPO#	Project	Slope	Aspect	Elev.	1st H2O	2nd H2O	
20IO220	LP	3.0	220	1300	20	20	
47FL165	PN	10.4	172	1212	100	80	
20DK6	TF	5.2	325	1085	100	140	
20DK42	WD	2.4	43	1375	50	400	
20DK27	BQ	9.0	178	1026	100	600	
20IO240	WD	0.0	225	1370	500	600	
20IO239	WD	2.1	202	1371	100	600	
20DK43	BQ	6.3	203	1034	100	650	
20IO241	WD	2.9	268	1373	400	700	
20DK36	WD	4.0	296	1383	200	760	
47FL31	MF	2.1	348	1137	100	782	
20IO228	LP	12.0	224	1335	100	805	
20DK33	WD	2.7	192	1377	50	895	
20DK28	BQ	6.9	73	969	100	1000	
20IO184	WD	3.3	133	1377	50	1020	
20IO1	MF	1.4	225	1131	100	1067	
20DK34	WD	0.0	180	1370	50	1160	
20IO185	WD	4.4	270	1385	100	1200	
20DK25	BQ	3.5	189	1034	100	1250	
20DK35	WD	3.0	112	1375	50	1345	
20IO242	WD	1.0	225	1370	450	1500	
20DK29	BQ	3.7	190	1032	100	1530	
20IO234	LP	0.0	270	1300	100	1600	
20IO246	WD	1.1	190	1370	1	1825	
20DK26	BQ	7.7	145	1058	575	1830	
20IO187	WD	0.8	180	1370	400	1855	
20IO244	WD	0.0	180	1370	250	1900	
20IO243	WD	1.0	135	1370	1100	2000	
20IO186	WD	2.4	142	1370	800	2050	
20DK24	BQ	3.8	178	1034	100	2066	93.4%
20DK30	BQ	0.7	190	1032	100	2600	
20IO238	WD	1.4	169	1372	1	2930	
32							



mean 1211.3
std. dev. 704.9

Table 7: Sorted by Elevation

SHPO#	Project	Slope	Aspect	Elev.	1st H2O	2nd H2O
20DK28	BQ	6.9	73	969	100	1000
20DK27	BQ	9.0	178	1026	100	600
20DK30	BQ	0.7	190	1032	100	2600
20DK29	BQ	3.7	190	1032	100	1530
20DK25	BQ	3.5	189	1034	100	1250
20DK43	BQ	6.3	203	1034	100	650
20DK24	BQ	3.8	178	1034	100	2066
20DK26	BQ	7.7	145	1058	575	1830
20DK6	TF	5.2	325	1085	100	140
20IO1	MF	1.4	225	1131	100	1067
47FL31	MF	2.1	348	1137	100	782
47FL165	PN	10.4	172	1212	100	80
20IO234	LP	0.0	270	1300	100	3090
20IO220	LP	3.0	220	1300	20	20
20IO228	LP	12.0	224	1335	100	805
20DK34	WD	0.0	180	1370	50	1160
20IO187	WD	0.8	180	1370	400	1855
20IO242	WD	1.0	225	1370	450	1500
20IO186	WD	2.4	142	1370	800	2050
20IO246	WD	1.1	190	1370	1	1825
20IO240	WD	0.0	225	1370	500	2950
20IO244	WD	0.0	180	1370	250	1900
20IO243	WD	1.0	135	1370	1100	2000
20IO239	WD	2.1	202	1371	100	2910
20IO238	WD	1.4	169	1372	1	2930
20IO241	WD	2.9	268	1373	400	2620
20DK42	WD	2.4	43	1375	50	400
20DK35	WD	3.0	112	1375	50	1345
20IO184	WD	3.3	133	1377	50	1020
20DK33	WD	2.7	192	1377	50	895
20DK36	WD	4.0	296	1383	200	760
20IO185	WD	4.4	270	1385	100	1200
32						



mean	1252.1
std. dev.	150.8